



## **FY 2014- 14-SCBGP-PA-0042**

### **Specialty Crop Block Grant Program – Final Report December 2017**

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| <p><b>Outreach Activities:</b></p> | <p>Affirmative steps were taken to conduct state outreach to socially disadvantaged farmers and beginning farmers of specialty crops by PDA. Potentials applicants were targeted through the Penn State University county extension offices, state and local associations, and the various USDA offices, to include FSA, NASS, RMA, USDA-RD and PDA economic development programs.</p> <p>The methods used to reach the targeted agricultural community included: press releases (300 PDA outlets, PR newswire service via the Governor’s office) being sent to all above outlets, as well as, eight trade journals targeting producers throughout Pennsylvania, the state Agricultural Newsletter and other community newspapers. Presentation of grant round was included in the PA Fruit &amp; Vegetable newsletter, mailings, and quarterly meeting.</p>   |
| <p><b>Competitive Process:</b></p> | <p>Recently, Pennsylvania Department of Agriculture received the summary results from the 2012 United States Department Agriculture’s National Ag Statistical Service (USDA-NASS) 2012 Census. The Ag census is conducted every five years. Results from the 2012 census indicated significant under-coverage of small farms. Methodological changes, extensive list building, and partnering with community based organizations enabled USDA-NASS to more accurately account for small farms in 2012. The USDA farm definition is all farms that produce or sell, or normally produce or sell, \$1,000 in agricultural products. USDA-NASS made extraordinary efforts to outreach to small and minority-operated farms and ranches. Census data was adjusted for non-response and for under-coverage using statistical methodology to provide the most accurate numbers possible. According to the 2012 Ag Census, Pennsylvania generated \$394.6 billion in Ag products sales vs. \$97 billion in 2007, a 33 percent increase in 5 years. The Preliminary 2014 Census data show the following key trends for Pennsylvania:</p> <ul style="list-style-type: none"> <li>• The land in farms in Pennsylvania showed a reduction from 2007 census, declining from 7.8 million acres to 7.7 million acres.</li> <li>• The number of farms was also down from 63,162 in 2007 to 59,302 in 2012.</li> <li>• The average age of a Pennsylvania farmer was 56.12 years in 2012, and increase from 55.2 in 2007.</li> <li>• The market value of agricultural products raised and sold from Pennsylvania was 7.4 billion dollars in 2012, a 27 percent increase from 2007.</li> <li>• In 2012 there were 8,460 operations in Pennsylvania that reported having a woman as the principle operator, with 4,252 of them listing farming as their primary operation.</li> </ul> <p>PDA received a total of fifty-two (52) specialty crop block grant concept papers; twenty-four (24) were deemed eligible. The total amount of requested dollars from the twenty-four (24) eligible grants was approximately \$1.7 million. Of the twenty-four (24) eligible applicants, twenty-four (24) were asked to submit a full proposal grant application.</p> <p>The grant applications were reviewed and prepared for presentation to the appointed specialty crop advisory board. Our board is chosen in a non-bias basis form. Anyone with association with a grant application that has been submitted cannot sit on the board. The thirteen (13) member board is composed of six (6) men and seven (7) women representing a variety of areas within the specialty crop industry. The board consists of individuals with</p> |

expertise in a wide range of agricultural commodities. The creation of the Specialty Crop Block Grant Board serves to satisfy the USDA-AMS program requirements of transparency, impartial review and oversight. The board represents expertise in production agriculture, distribution, retail, marketing, research, nutrition, and education. Each member represents a level within the specialty crop industry necessary for impacting the availability, consumption and future policy of the industry. The board members were invited based on their professional resumes, and ability to provide impartiality.

The board reviewed the all proposals and scored them based on eligibility and organized into five categories and five commodity groups. The Committee commented and scored proposal's then provided recommendation for fundability. All projects receiving an average score of above 80 percent was considered worthy of funding.

Upon completion of the Specialty Crop Advisory Board Meeting, twenty (20) applications were chosen for funding. The requested amount from the twenty (20) projects totaled \$1,750,758.55 Pennsylvania has been allocated \$1,039,933.92, due to the lowered allocation many projects were granted awards lower than the requested amount. All projects were reviewed by the advisory committee; the results of the peer review were kept confidential. During the SCBG advisory board meeting members were invited to give feedback, all meeting notes were recorded and kept confidential. Letters and email notification is sent to notify all award recipients and non-recipients after the Secretary for the Pennsylvania Department of Agriculture has signed off on the award amounts. All notification letters were signed by the secretary.

**Grant Administration:**

The Pennsylvania Department of Agriculture realizes the important role the Specialty Crop Block Grant program plays within its state and the Northeast, as it currently has the fifteenth largest budget in the country. The department will use \$285.57 of the grant funds for direct and indirect costs. These funds will be used for travel for the specialty crop block grant coordinator. The specialty crop block grant coordinator will be responsible for the reports to the federal agency, documentation, and grantee performance monitoring. Indirect costs will be at 8%.

Semi-annual progress reports and financial reports submitted to the Department will be one of the tools that the grant administrator will use to monitor projects within this State Plan. Reports will be used to ensure work is completed within the required timeframe, ensure that specialty crop block grant funds supplement the expenditure of state funds in support of specialty crops grown in the State, rather than replace state funds. If a projects grant period is over a year, a site visit will be performed.

SCBGP-FB 2014 Grant administration justification of travel costs.

Site visits: (\$285.57)

- 20 sub-grant applicants SCBGP-FB 2014

Harrisburg events no official travel required (take place at farm show):

- PA Farm Show & reception

| Category                              | Amount  |
|---------------------------------------|---|
| Travel                                | \$285.57  |
| Total Direct Costs for Administration | Using management directives in accordance with Pennsylvania Law |

Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

| Summary of Project Budgets: | Project | Name  | Direct    | Indirect | Award      |
|-----------------------------|---------|---|-----------|----------|------------|
|                             | 1       | IPM for Amish and Mennonite Greenhouse, High Tunnel and Field Vegetable Farms in York County.   | 51,669.00 | 4,133.00 | 55,802.00  |
|                             | 2       | Identify Potato Varieties for Par-Frying for the Pennsylvania Potato Industry   | 96,579.00 | 3,726.00 | 100,305.00 |
|                             | 3       | Improving Tomato Profitability Through Refining Foliar Nutrition Applications   | 29,831.00 | 2,596.00 | 32,427.00  |
|                             | 4       | Peach Nutrition & Promotion Campaign - Year 2   | 63,000.00 |          | 63,000.00  |
|                             | 5       | Keep Tasting on the Pennsylvania Wine Trails- The Ultimate Agritourism Experience   | 40,000.00 |          | 40,000.00  |
|                             | 6       | PA Preferred Culinary Connection with focus on promoting Pennsylvania Specialty Crops   | 47,330.00 | 2,670.00 | 50,000.000 |
|                             | 7       | Packaged Processed Apple Product Innovation Marketing Research  | 30,000.00 |          | 30,000.00  |
|                             | 8       | Sustainable Production, Pest Management, and Market Innovations for Next Generation Specialty Crop Producers from Diverse Backgrounds | 71,431.00 | 6,214.00 | 77,645.00  |
|                             | 9       | Marketing and Accessing More Specialty Crops in Fayette County  | 30,000.00 |          | 30,000.00  |
|                             | 10      | Developing Ecologically-Based Tree Fruit IPM Programs That Conserve Managed & Wild Pollinators  | 49,000.00 |          | 49,000.00  |
|                             | 11      | Small Apples, Big Impact: Connecting Cosmetically Imperfect Specialty Crops to Farm to School Programs                                | 37,040.00 | 2,960.00 | 40,000.00  |
|                             | 12      | Increasing the Food Safety Practices among the Specialty Crop Producers   | 50,759.35 | 1,000.00 | 51,759.35  |

Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

|                     |  |  |            |           |              |
|---------------------|--|--|------------|-----------|--------------|
|                     | 13   | Farm Succession for Specialty Crop Growers in Western Pennsylvania   | 22,152.00  | 1,772.00  | 23,924.00    |
|                     | 14   | Turning on Natural Pest Resistance in Tomato and Pepper Using Seed Treatments  | 55,002.00  | 4,784.00  | 59,786.00    |
|                     | 15   | Vegetable Industry Strategic Planning Implementation   | 60,000.00  |           | 60,000.00    |
|                     | 16   | Education Assistance Program for Specialty Crops Growers   | 30,556.00  | 2,444.00  | 33,000.00    |
|                     | 17   | Improved Management of Onion Bacterial Diseases Through Increased Understanding of Pathogens Epidemiology and Research Based Management Strategies | 46,000.00  | 4,000.00  | 50,000.00    |
|                     | 18   | Expanding Best Practices Programs in the Mushroom Industry   | 55,200.00  | 4,800.00  | 60,000.00    |
|                     | 19   | Workplace Safety Training for the Mushroom Industry  | 55,200.00  | 4,800.00  | 60,000.00    |
|                     | 20   | Enhanced Preparedness Against Pathogens that Threaten Specialty Crop Production and Markets  | 67,155.00  | 5,845.00  | 73,000.00    |
|                     |  |  |            |           | 1,039,648.35 |
| <b><u>TOTAL</u></b> |  |  | 987,904.35 | 51,744.00 |              |
|                     |  |  |            |           |              |
| <b>Project 1</b>    | IPM for Amish and Mennonite Greenhouse, High Tunnel and Field Vegetable Farms in York County   |  |            |           |              |
| Project Summary:    | For any farm, regardless of the location, the operator or the crop being raised, raising a healthy and plentiful crop is the ultimate goal. Geography can put certain states at a distinct advantage in production of certain crops. Obviously certain climates are better suited to producing particular crops. Pennsylvania's sometimes cooler climate may not allow for the same volume of tomatoes and cucumbers produced as some of the warmer southern or western states, but by growing in a greenhouse or high tunnel to extend the growing season Pennsylvania's can remain competitive with those out of state producers. Growing produce in |  |            |           |              |

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|                   | <p>high tunnels or greenhouses, however can limit the pesticides that may be used for the control of some common insect pests, which can be another major hindrance to vegetable production.</p> <p>Control of major pests can be achieved with a limited pesticide arsenal through the use of Integrated Pest Management (IPM). This is a pest control strategy that incorporates trapping, scouting, biological control and a number of other techniques that can limit or even eliminate the use of traditional pesticides. Some of these techniques used in an IPM program require training to incorporate them into a traditional farm operation. While there are numerous web resources describing these IPM techniques, including extension webinars, and even live presentations at various meetings, there is one group of people that have limited or even no access to these resources. For the Amish and conservative Mennonites, whose religious philosophy restricts their use of technology and motorized transportation, accessing these trainings is often not an option. This project aimed to help fill this educational gap.</p> <p>As part of the 2015 growing season, project coordinator Cathy Thomas worked with 4 York County Amish and Mennonite vegetable farmers who agreed to incorporate integrated pest management strategies on their farms. These farms all had either a greenhouse or high tunnel on their farms that they were using to get an early start on vegetable crops. Cathy's work with the growers involved weekly or bi-weekly visits throughout the entire growing season working with them one-on-one to demonstrate how to scout for pest issues in their crops, how to set traps to assist in monitoring, how to recognize symptoms of environmental issues, and how to make decisions about which control options to use for the various pests found in the tunnels and houses.</p> |
| Project Approach: | <p>In order to build the IPM educational effort to Amish and Mennonite growers in York County the project team selected the following objectives to work toward:</p> <ol style="list-style-type: none"> <li>1. Within a greenhouse crop cycle (January/February – June/July) working with an IPM specialist, growers will have learned insect pest life cycles and IPM techniques such as scouting, using sticky traps and record keeping.</li> <li>2. Growers will become knowledgeable on the selection of reduced-risk chemical options and on the selection and proper release of biological controls.</li> <li>3. Because of practice changes, growers will be able to introduce commercial bumblebee hives to increase production and improve quality of early vegetable crops such as tomatoes, cucumbers and peppers.</li> </ol> <p>These objectives were intended to help the participating farms make IPM a permanent part of their farm operations and also to explore other sustainable techniques that would enhance their pest management program and also improve the functionality of the whole farm. The advice and mentorship of the IPM consultant would help the growers to do this.</p> <p>To select the participating farmers, information about the project was shared with growers at Sunnyburn produce auction in York County. Word was also shared with growers who have worked with Cathy Thomas before. Through this word of mouth, four vegetable growers were</p>  |

found with either a high tunnel or greenhouse on their properties. The project coordinator met with each grower before the growing season began to discuss their previous pest management practices. This included the number of pesticide applications each farm had made and the type of pesticide products they used. They also talked about the expectations that each grower had for the 2015 growing season, such as reducing the number of pesticide applications made in each tunnel.

*EDUCATING GROWERS IN IPM TECHNIQUES:* The four vegetable grower participants in this project share a similar crop mix. The two main crops that were the focus of this project were tomatoes and cucumbers. For each of these crops, there are some important pests that they needed to learn life cycles and habits for so that they could better understand the best time and method of control could be used. For Tomatoes, some of these pests are aphids, two-spotted spider mites, whiteflies and tomato fruitworms (also known as corn earworm). Each of these pests has a different monitoring strategy. For aphids, growers can monitor plants for signs of glistening honey dew (a sticky excretion made by aphids) and can also monitor yellow sticky traps which will attract aphid adults. For the two-spotted spider mites, the monitoring strategy is to scout plants along the edges of the plant blocks where they meet up with dusty soil/gravel paths. Spider mites thrive in dusty, dry areas. For tomato fruitworm, a migratory moth pest, the best way to monitor for this pest is to set pheromone traps near tunnels and field grown tomatoes or corn. The traps should be regularly monitored around the middle of June. Trap catches are also reported from other areas in Pennsylvania on Penn State's Pestwatch website, [www.pestwatch.psu.edu](http://www.pestwatch.psu.edu). As for the cucumber crop, these plants are host to thrips, spider mites and cucumber beetles. For management of cucumber beetles, the best approach has been to apply screening material around the greenhouse to prevent migration into the greenhouse. Cathy helped the growers learn this information on each pest, but there were many more pests that the growers had to learn about.

*INTRODUCTION OF BENEFICIALS INTO THE GREENHOUSE/HIGH TUNNEL ENVIRONMENTS:* The second objective of this project was to exchange traditional insecticides and miticides with softer, reduced-risk insecticides (biorational). This change will not only be better for the employees who had to use the harsher pesticides, but some of the softer pesticides make it possible for beneficial insects to survive in the target crop. Through consultation of pesticide sheets produced by IPM Program scouting consultant Brian Schildt and the advice of Cathy Thomas, growers were able to reduce or eliminate the products they had been using. On each of the participating farms, growers were also trained in the release and maintenance of biological control organisms. Project leader Cathy Thomas shared her knowledge gained through years of experience with biocontrols. With the proper release rates and number of releases, the population of biocontrols can keep vegetable pests such as aphids, two-spotted spider mites, fungus gnats and others in acceptable levels for a successful vegetable program.

*BUMBLE BEES AND POLLINATORS:* Another objective of this project was to help growers to incorporate commercially available bumble bee hive into their greenhouses and high tunnels. The use of bumble bees in a greenhouse or high tunnel will greatly improve the level of pollination, which in turn increases the level of vegetable production. In order to achieve this goal, traditional pesticide use has to be greatly reduced or eliminated. Cathy helped the



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|                              | growers to modify their habits to make this incorporation possible.  |
| Goals and Outcomes Achieved: | <p>One goal of the project was that four growers would adopt IPM practices on 15-20% of their farm acreage.</p> <p>Another goal of the project was to see an increase in the amount of reduced risk products used on participating farms and a reduction in the amount of traditional pesticides used. Lastly, the broader vegetable growers community will be reached by the activities of this grant by the presentations given to larger groups of vegetable growers and through a pamphlet sharing the messages of this project to different groups of growers.</p> <p><b>Grower No. 1 – York County, Greenhouse Tomatoes</b></p> <ul style="list-style-type: none"> <li>- Variety, Rebelski, Beefsteak</li> </ul> <p>Main goals achieved: Reduced pesticide use, introduction of bumble bees and biocontrols for pest control.</p> <p>This was the first year of production for this grower. He is a young Amish man and sells his produce at the local Sunnyburn produce auction and to some direct outlets that he has established. Production started in late February with the installation of transplants into the growing house. This greenhouse crop is heated with wood burning furnace. Visits with the grower started on a weekly basis. This grower expressed a strong interest in using bumble bees for pollination, and biocontrols in place of pesticides. The use of bumble bees for pollination was explained to him and he decided to introduce a hive into the greenhouse when the first set of blossoms appeared. A Class B Hive was purchased for pollination in greenhouses from 5000-10,000 square feet. On delivery, this hive contained at least 75-100 workers bees. It has an expected life span of 8-10 weeks. Bumble bee pollination is particularly useful in the months of February through April when humidity is high. Bumblebees pollinate flowers through a method called “buzz pollination”, a rapid vibrating motion which releases large amounts of pollen onto the bee. In most situations, “buzz pollination” will allow a bumblebee to pollinate a flower in a single visit. This type of pollination results in better distribution of pollen preventing catfacing (scarring) on fruit and often produces a heavier fruit. This grower was very pleased with the effectiveness of the bumble bees and plans to use them in future crops.</p> <p>The grower was advised to use yellow sticky traps throughout the greenhouse to monitor for thrips and whiteflies. When insects were found on the sticky cards, we identified them with the use of the “Greenhouse IPM with An Emphasis on Biocontrols Manual”. The main pest of this crop for the growing season was the development of Two-Spotted Spider Mite. He chose to introduce a predatory mite - <i>Phytoseiulus persimilis</i>. This predatory mite is released at first sign of mite infestation. This predatory mite consumes egg, nymphs and adult stages of pest mites. Light infestations can be controlled within 2-3 weeks. Since the mites were detected early and at low populations through weekly scouting procedures only two introductions of the predator mite were required. The grower was taught how to determine the correct</p> |

biocontrol to use for the pest, and how to order biocontrols from a supplier.

No pesticides were used to control pests in the greenhouse. Additionally, since this grower also grows sweet corn, a pheromone trap was set up near the greenhouse to monitor for Tomato Fruitworm (also a pest of corn, Corn Earworm). This pest can be very destructive to maturing tomato fruit if moths lay eggs in the greenhouse. Using this traps served a dual purpose of monitoring in the greenhouse but also in the sweet corn crop. This grower was also instructed on identification of sweet corn pests and how to monitor for corn earworm damage in sweet corn. By deploying the pheromone traps this grower was able to time sprays for corn earworm more effectively. Many produce buyers look for his corn at the Sunnyburn auction. He was instructed on using reduced-risk insecticides for his sweet corn crop which provided the same control or better than using a more toxic product (i.e., synthetic pyrethroids). While scouting the sweet corn crop, the IPM consultant was able to identify many natural enemies throughout the crop. The grower was very pleased and interested to see and identify these “beneficial insects” in his crop.

This grower was pleased with the results he achieved by implementing IPM procedures and bumble bee pollination in his tomato crop. He sold a large percentage of his crop at the Sunnyburn produce auction. This produce could be sold as pesticide free since no pesticides were used in the production house.

#### **Grower No. 2 – York County, Greenhouse cucumbers**

- Corinto – greenhouse variety

Main goals achieved: Reduced pesticide use, introduction of biocontrols for pest control, and implementing pest exclusion as an IPM technique.

This grower is a young Amish man who grows produce and markets it through the local Sunnyburn produce Auction and through direct outlets that he has established. This is the second year of production of this crop. The grower had several pest issues the first year of production so he expressed interest in using IPM methods for the 2015 crop.

Scouting started in March, 2015 when cucumber transplants were installed into the growing house. Within several weeks, the crop was host to thrips feeding on the undersides of the leaves. Thrips can also feed on cucumber blossoms disturbing pollination and causing fruit distortion. The grower was instructed on the correct biocontrol to introduce – *Amblyseius cucumeris*, a predatory mite. This thrips predator feeds on the young stages of thrips primarily, as the adults are too large for them to kill. Therefore, releases are most effective when populations are low.

For this crop a controlled release sachet (CRS System) was implemented. Mites are continuously released over a period of 6 weeks or more. The success of the CRS sachet is that the predator is not reliant on food being available on the plant as it is a stand-alone breeding

colony inside the sachet. As warmer temperatures developed in late April another CRS System was introduced into the crop. This provided long term control throughout the growing season. In April, another serious pest was found infesting this crop, Striped Cucumber Beetle. Since this grower found labeled pesticide products ineffective in 2014, he chose to implement an exclusion technique with the use of screening material. This fine mesh screen was attached to the sides of the greenhouse. Through use of the screening and keeping end doors closed at all times the number of beetles in the greenhouse was reduced substantially. The development of bacterial wilt (transmitted by beetles) on the cucumber plants was reduced over 75% from the previous year.

The grower was very pleased with the IPM techniques that were implemented in his cucumber crop. He felt that it helped him produce a high quality product that was recognized by many buyers at the auction.

No chemical pesticides were used in the production of this cucumber crop.

**Grower No. 3 – York County, high tunnel tomatoes**

- Red deuce, fabulous and scarlet red – field varieties

Main goals achieved: Reduced pesticide use, integration of biorational compounds with biological controls (predators).

This grower is an Amish woman who grows high tunnel tomatoes for early sales at a produce stand that she manages with her family. She also sells her tomatoes at the local Sunnyburn produce auction. Scouting began in mid-March when tomato transplants were planted the high tunnel. This grower uses supplemental wood heat. One of the main issues in high tunnels is the development of two-spotted spider mite.

Population development began in mid April with mites on lower leaves. Before introducing spider mite predators, the grower wanted to try a biorational spray to reduce mite populations. Suffoil-X™, an ultra fine spray oil was recommended instead of a chemical miticide. This unique oil is emulsified into small oil particles providing better coverage of the insect and also less burning of foliage. After several applications, the grower wanted to use the predatory mite, - *Phytoseiulus persimilis*. Three applications of predator mites were used over a six week period. This provided marginal control so the grower resumed the Suffoil-X™ spray application.

This is a good example of integrating biorational spray compounds with biocontrols to achieve the desired control.

Another issue that plagues high tunnel tomatoes is the development of the disease, leaf mold or *Fulvia fulva*. This disease is more common in protected environments such as high tunnels since there is less air movement. The tomato varieties grown in this tunnel have low tolerance to this disease so preventive sprays of the biorational fungicide Milstop™ were used.

This grower was satisfied with IPM techniques that were used to produce her crop. Customers are made aware of the use of IPM on their entire farm.

**Grower No. 4 – York County, high tunnel tomatoes**

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|  | <ul style="list-style-type: none"> <li>- Red deuce – field variety</li> </ul> <p>Main goals achieved: Reduced pesticide use, integration of biorational compounds with biological controls (predators), use of bumble bees for pollination purposes.</p> <p>This grower is a young Amish man who has grown high tunnel tomatoes for 3 years. He has expressed an interest in learning IPM techniques in place of insecticide and fungicide applications. Scouting with this grower was started in mid-February when tomato transplants were planted in the high tunnel. This grower uses a wood fired furnace for supplemental heat. In previous years, he used a blower for pollination but decided to introduce Bumble bees for better pollination of early fruit. After the first set of blossoms emerged, a Class B hive was put in the tunnel. Bumble bees are still active at relatively low temperatures (around 50°F) and low light intensity levels, so they are not affected by cold temperatures that can occur in high tunnels. This grower felt that he had more No. 1 tomatoes with the Bumble bee pollination and will use them in next year's crop.</p> <p>Due to the very humid summer, disease incidence was very high. Leaf mold (<i>Fulvia fulva</i>) began to develop in early June. Instead of using a traditional fungicide this grower was interested in using a reduced risk option. He chose to the Suffoil-X™, ultra-spray oil product which is indicated for controlling foliar diseases. He felt that the control achieved was acceptable, and therefore no other fungicides were used.</p> <p>Two-spotted spider mite populations were observed while scouting with the grower in late June. Along with the collateral sprays of Suffoil-X™, <i>Phytoseiulus persimilis</i>, predatory mite, was introduced to control hot spots throughout the tunnel. The grower felt that the control achieved was acceptable.</p> <p>This grower sold his crop at the Sunnyburn produce auction.</p> <p>Overall, the growers involved in this project eliminated the use of traditional/high risk pesticides.</p> <p>There was a 100% decrease in the use of these products on their farms.</p> <ul style="list-style-type: none"> <li>• Percentage increase in the use of reduced risk pesticides and biocontrols</li> </ul> <p>There was a 100% increase of in the use of reduced risk pesticides and biocontrols on the farms involved in this project. These growers were all willing to change their practices and adopt alternative methods of pest control.</p> <ul style="list-style-type: none"> <li>• Percentage decrease in the number of acres treated with a higher risk pesticide</li> </ul> <p>There was a 100% decrease in the number of acres treated with high risk pesticides.</p> <ul style="list-style-type: none"> <li>• Percentage increase in total acres managed with IPM</li> </ul> |
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Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

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|------------------|---|
|                  | <p>There was a 100% increase in total acres managed with IPM (biocontrols, scouting and pest identification, reduced risk pesticides (biological insecticides and fungicides and soft pesticides).</p>  |
| Beneficiaries:   | <p>The beneficiaries directly affected by this project are: (1) Mervin Zook, (2) Isaac Miller, (3) Mary Miller, (4) Michael Esh. These growers have expressed their satisfaction with the results of the project as well as the opportunity to learn the scouting techniques and the use of biocontrols. Amish farmers/growers share many of these IPM techniques with their families and friends. Information is often exchanged at family gatherings as well as church which is held at homes.</p> <p>The results that have been gathered over the course of this project on both the incorporation of biocontrol organisms and of the use of reduced risk pesticides will be shared with larger groups of vegetable growers. In the spring of 2015, Cathy Thomas led a Biocontrol Workshop for greenhouse and high tunnel vegetable growers at Penn State University. Information from this project was shared with those growers. Also, in February of 2016, Cathy Thomas will be speaking to a group of growers at the Mid-Atlantic Fruit and Vegetable Meeting about IPM in High Tunnels. These meetings are always well attended by growers from Pennsylvania and other Mid-Atlantic states.</p> <p>Lastly, throughout the course of this project a series of pamphlets on the use of IPM in High Tunnels has been produced. These pamphlets will be professionally printed in fall of 2015 and will be available to growers at Sunnysburn Produce Auction and also to growers attending the Mid-Atlantic Fruit and Vegetable meeting. These brochures will also be made available for download on the PA IPM Program website, <a href="http://www.paipm.org">www.paipm.org</a>, which will greatly increase the scope of the growers touched by this project. Additionally, growers were given the information to obtain the new PAIPM publication, "Vegetable Integrated Pest Management with an Emphasis on Biocontrol". The publication is available from the Penn State Agriculture Publishing Department, Penn State University.</p> |
| Lessons Learned: | <p>Over the course of this Specialty Crop project, project leaders have found that the participating growers have embraced the concepts of IPM and have made a permanent change in how they handle pest control. They have learned to value the information that can be gained through scouting and they have showed that they care about the types of products that are used on their farms.</p>   |
| Contact Person:  | <p>Cathy Thomas, 2301 N. Cameron St, Harrisburg, PA 17110<br/> Phone: 717-772-5204<br/> Fax: 717-705-6518<br/> <a href="mailto:caththomas@state.pa.us">caththomas@state.pa.us</a></p>   |
|                  |   |
| <b>Project 2</b> | <b>Identify Potato Varieties for Par-Frying for the Pennsylvania Potato Industry</b>  |
| Project Summary: | <p><i>Par-fried potato products provide a new opportunity for Pennsylvania Potato Growers. Keystone Potato Products, Inc. (KPP) has the capacity to produce these par-fried potato</i></p>  |

|                   |   |
|-------------------|---|
|                   | <p><i>products to meet market demand. However, the current potato varieties grown in Pennsylvania are not well suited for par-frying.</i> The reason for this is the lack of high quality processing potato varieties under Pennsylvania conditions. Some popular processing potato varieties in the U. S. are not grown well and not suitable for processing in Pennsylvania. In order for Pennsylvania growers to produce more potatoes for processing, it is necessary for the potato industry to come up with varieties that make good processing (particularly par-frying) quality products both at harvest and after storage for various periods of time. This is the second year of a multiple year research project. The objectives of this project were: 1) Evaluate potato germplasm for par-frying processing; 2) Evaluate cultural field practices to determine how Pennsylvania potato quality could be improved; 3) Determine the most suitable varieties for par-frying in Pennsylvania; and 4) Recommend potato varieties and cultural practices with high yield and good processing quality to Pennsylvania potato growers. In 2015, we evaluated 286 potato varieties/breeding clones in Center County, 40 in Lehigh County and 40 in Erie County. We had commercial trials of 8 potential par fry varieties in three counties in Pennsylvania. These 8 potential par fry varieties were selected based on the results of 2014 evaluation trials. Varieties and breeding lines suitable for par-frying under Pennsylvania field conditions were recommended to Pennsylvania potato growers and industry via meetings, printed reports and personal contacts.</p>  |
| Project Approach: | <p><b>Objective 1:</b> Evaluate potato germplasm for par-frying processing. (Robert Leiby, Roger Springer, PA Co-Op; Mike Peck, Xinshun Qu, Penn State)</p> <p><b>Activities:</b><br/>           Potential potato varieties and advanced breeding clones for par-frying were obtained from other potato breeding programs in the US and Canada. These varieties were planted in two major potato growing regions of Pennsylvania and at the Russell E. Larson Agricultural Research Center at Rock Springs, PA in May in 2015. At the Rock Springs location we planted a total of 286 varieties/breeding clones. At the Lehigh Co. location we planted a trial with 40 varieties/breeding clones. At the Erie Co. location we planted a trial with 40 varieties/breeding clones. All trials at three locations were harvested in September and October 2015. Tubers were evaluated for all tuber characteristics. 51 varieties from Rock Spring trial, 11 varieties from Lehigh County trial and 11 varieties from Erie Co. trial were selected for fry test at Penn State chip lab. The test results were shown in Table 1, 2, and 3.</p> <p>We selected 8 potential par-frying varieties based on data of 2014 evaluation trials and these 8 varieties were planted in commercial trials in three locations in Pennsylvania in 2015. About 200 - 300 lbs. of each variety were planted. The commercial trials were harvested in September 2015 and were evaluated for yield and fry qualities at Penn State Chip Lab and for par fry quality by KPP (Table 4 - 5 and Photo 1).</p> <p><b>Significant results, accomplishments, conclusions and recommendations:</b><br/>           Several potential par-fry potato varieties were selected based on the data of 2014 and 2015 evaluation trials.</p> <p><b>Objective 2:</b> Evaluate cultural field practices to determine how Pennsylvania potato quality</p> |

|                              |   |
|------------------------------|---|
|                              | <p>could be improved. (Robert Leiby, Roger Springer, PA Co-Op; Mike Peck, Xinshun Qu, Penn State)</p> <p><b>Activities:</b><br/>Cultural field practices of the best par-fry potato varieties were performed in 2016 through field testing of potato seed spacing, fertilizer rate and disease resistance. All trials were just harvested in October 2016 and the data are being collected and analyzed.</p> <p><b>Objective 3:</b> Determine the most suitable varieties for par-frying in Pennsylvania. (Robert Leiby, Roger Springer, PA Co-Op; Mike Peck, Xinshun Qu, Penn State)</p> <p><b>Activities:</b><br/>After harvest and during storage, samples were evaluated for all appropriate characteristics and processing quality. Some samples were evaluated for fry processing at both Penn State and KPP. Statistical analyses were performed on the data of 2014 and 2015 trials and the best varieties of potatoes for par-frying under Pennsylvania field conditions were selected.</p> <p><b>Significant results, accomplishments, conclusions and recommendations:</b><br/>Four best par-fry potato varieties (Norwis, Easton , Ambassador, Performer) were selected based on the data of 2014 and 2015 evaluation trials. These varieties are being evaluated for cultural practices such as seed spacing, fertilizer rate and disease resistance in 2016.</p> <p><b>Objective 4:</b> Recommend potato varieties and cultural practices with high yield and good processing quality to Pennsylvania potato growers. (Robert Leiby, Roger Springer, PA Co-Op; Mike Peck, Xinshun Qu, Penn State)</p> <p><b>Activities:</b><br/>We provided results of 2014 and 2015 our par fry trials to Pennsylvania potato growers and industry via printed research reports, demonstration trials, meetings, personal contacts and newsletters (Table 6 and Photo 2).</p> <p><b>Significant results, accomplishments, conclusions and recommendations:</b><br/><br/>Pennsylvania Potato Growers are aware of the Par Fry work we are doing. The best par-fry potato varieties were introduced to Pennsylvania potato growers and industry.</p> |
| Goals and Outcomes Achieved: | We identified four potato varieties that have qualities for par fry under Pennsylvania field conditions. Varieties suitable for par fry were recommended respectively for Pennsylvania potato growers and industry. These varieties are being evaluated for cultural practices In Pennsylvania in 2016 trials.  |
| Beneficiaries:               | All Pennsylvania potato growers and industry are benefiting from this project. The results of our field trials and commercial trials provide growers information on yield, internal and external defects, specific gravity, overall appearance, disease resistance, processing quality of different potato varieties. We provided educational presentations on par fry processing to Pennsylvania potato growers and industry. We expect Pennsylvania growers begin to grow   |

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|                          |   |                            |         |                       |                      |          |                   |                   |    |
|--------------------------|---|----------------------------|---------|-----------------------|----------------------|----------|-------------------|-------------------|----|
|                          | par fry varieties and supply them to industry such as KPP to produce par fry products to meet demand for this yet untapped market.  |                            |         |                       |                      |          |                   |                   |    |
| Contact Person:          | Roger Springer<br>PA Co-operative Potato Growers, Inc.<br>3107 North Front Street, Suite 100<br>Harrisburg, PA 17110<br>Telephone Number: 717-232-5300<br>Email Address: <a href="mailto:rspringer@pacooppotatoes.com">rspringer@pacooppotatoes.com</a> |                            |         |                       |                      |          |                   |                   |    |
| Additional Information:  | Table 1. Total yield, greater than 1 7/8" yield, specific gravity, and French fry color for russet skinned or long white potato evaluation trial at Rock Springs Plant Pathology Farm, 2015 - 2016.   |                            |         |                       |                      |          |                   |                   |    |
|                          | <hr/>   |                            |         |                       |                      |          |                   |                   |    |
|                          | Variety/<br>Color <sup>4</sup>  | Yield (cwt/A) <sup>1</sup> |         | % of                  | Percent <sup>3</sup> | Specific | French Fry        |                   |    |
|                          | Line  | Total                      | >1 7/8" | Standard <sup>2</sup> | Pickouts             | Gravity  | Dec. <sup>5</sup> | Jan. <sup>6</sup> |    |
|                          |   | Feb. <sup>7</sup>          |         |                       |                      |          |                   |                   |    |
|                          | <hr/>   |                            |         |                       |                      |          |                   |                   |    |
|                          | Palisade Russet   | 353                        | 220     | 77                    | 30                   | 1.104    | 1                 | 0                 | 0  |
|                          | Russet Burbank  | 403                        | 252     | 88                    | 31                   | 1.086    | 1                 | 1                 | 1  |
|                          | Russet Norkotah   | 369                        | 287     | 100                   | 9                    | 1.081    | 1                 | 1                 | 1  |
|                          | Teton Russet  | 442                        | 316     | 110                   | 21                   | 1.081    | 1                 | 1                 | 1  |
|                          | Easton  | 414                        | 358     | 124                   | 5                    | 1.096    | 00                | 00                | 00 |
|                          | Caribou Russet  | 324                        | 227     | 79                    | 24                   | 1.090    | 0                 | 0                 | 1  |
|                          | AF4113-2  | 429                        | 361     | 126                   | 10                   | 1.087    | 0                 | 00                | 0  |
|                          | AF4124-7  | 359                        | 242     | 84                    | 18                   | 1.090    | 0                 | 1                 | 1  |
|                          | AF4172-2  | 428                        | 381     | 133                   | 3                    | 1.096    | 0                 | 0                 | 0  |
|                          | AF4296-3  | 389                        | 257     | 89                    | 20                   | 1.101    | 0                 | 0                 | 00 |
|                          | AF4953-6  | 474                        | 403     | 140                   | 13                   | 1.094    | 0                 | 0                 | 0  |
|                          | AF5057-13   | 515                        | 392     | 136                   | 16                   | 1.106    | 0                 | 00                | 00 |
|                          | AF5091-2  | 312                        | 212     | 74                    | 17                   | 1.083    | 1                 | 1                 | 1  |
|                          | AF5164-19   | 477                        | 384     | 134                   | 13                   | 1.088    | 00                | 0                 | 0  |
|                          | Dakota Trialblazer  | 387                        | 345     | 120                   | 4                    | 1.116    | 00                | 0                 | 00 |
|                          | AF5203-7  | 456                        | 315     | 110                   | 17                   | 1.091    | 1                 | 1                 | 1  |
|                          | A08422-2VR  | 474                        | 412     | 143                   | 10                   | 1.087    | 1                 | 1                 | 1  |
|                          | A06021-1T   | 366                        | 274     | 95                    | 14                   | 1.091    | 0                 | 1                 | 1  |
|                          | Fontane <sup>YF</sup>   | 387                        | 309     | 108                   | 4                    | 1.099    | 1                 | 1                 | 0  |
|                          | Lady Amarilla <sup>YF</sup>   | 368                        | 304     | 106                   | 6                    | 1.087    | 1                 | 1                 | 1  |
|                          | Bintje <sup>YF</sup>  | 395                        | 242     | 84                    | 28                   | 1.086    | 0                 | 0                 | 0  |
| Performer <sup>YF</sup>  | 382   | 332                        | 116     | 9                     | 1.085                | 1        | 1                 | 1                 |    |
| Ambassador <sup>YF</sup> | 452   | 317                        | 110     | 15                    | 1.092                | 1        | 1                 | 1                 |    |
| Norwis                   | 261   | 226                        | 79      | 9                     | 1.075                | 00       | 0                 | 1                 |    |
| AF4283-1*                | 456   | 290                        | 101     | 26                    | 1.088                | 0        | 1                 | 1                 |    |



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|                      |     |     |     |    |       |    |    |    |
|----------------------|-----|-----|-----|----|-------|----|----|----|
| AF5060-27*           | 395 | 345 | 120 | 4  | 1.081 | 1  | 1  | 0  |
| AF5071-2*            | 421 | 335 | 117 | 8  | 1.097 | 00 | 00 | 0  |
| W9133-1rus*          | 365 | 326 | 113 | 10 | 1.078 | 0  | 0  | 0  |
| W9433-1rus*          | 407 | 337 | 117 | 15 | 1.088 | 0  | 0  | 00 |
| A06084-1TE*          | 295 | 187 | 65  | 12 | 1.085 | 00 | 00 | 00 |
| Dione* <sup>YF</sup> | 558 | 482 | 168 | 12 | 1.096 | 0  | 0  | 00 |
| Cal White*           | 501 | 403 | 140 | 17 | 1.092 | 1  | 1  | 0  |
| AF4950-2*            | 392 | 321 | 112 | 9  | 1.089 | 0  | 0  | 0  |
| AF5312-1*            | 491 | 353 | 123 | 24 | 1.084 | 0  | 0  | 1  |
| AF5487-8*            | 283 | 226 | 79  | 0  | 1.082 | 00 | 0  | 0  |
| AF5488-10*           | 435 | 334 | 116 | 10 | 1.080 | 1  | 1  | 1  |
| AF5494-2*            | 381 | 333 | 116 | 11 | 1.091 | 0  | 0  | 1  |
| AF5511-4*            | 361 | 250 | 87  | 28 | 1.099 | 0  | 0  | 0  |
| AF5518-1*            | 348 | 287 | 100 | 9  | 1.081 | 00 | 0  | 0  |
| AF5521-1*            | 400 | 347 | 121 | 10 | 1.104 | 00 | 0  | 00 |
| AF5521-6*            | 362 | 268 | 93  | 16 | 1.099 | 00 | 0  | 00 |
| AF5522-5*            | 334 | 304 | 106 | 2  | 1.086 | 0  | 0  | 0  |
| AF5550-11*           | 364 | 260 | 91  | 22 | 1.082 | 0  | 0  | 0  |
| COAF10004-3*         | 437 | 247 | 86  | 32 | 1.091 | 0  | 1  | 1  |
| A08014-9TE*          | 297 | 273 | 95  | 1  | 1.080 | 1  | 1  | 1  |
| A03873-3NV*          | 362 | 254 | 88  | 11 | 1.080 | 00 | 00 | 0  |
| A06914-3CR*          | 449 | 278 | 97  | 31 | 1.093 | 00 | 0  | 1  |
| A01025-4*            | 279 | 240 | 84  | 5  | 1.097 | 00 | 00 | 0  |
| A07103-1T*           | 285 | 248 | 86  | 0  | 1.100 | 00 | 0  | 00 |

Table 1. Continued.

| Variety/<br>Color <sup>4</sup> | Yield (cwt/A) <sup>1</sup> |         | % of                  | Percent <sup>3</sup> | Specific | French Fry        |                   |   |
|--------------------------------|----------------------------|---------|-----------------------|----------------------|----------|-------------------|-------------------|---|
| Line                           | Total<br>Feb. <sup>7</sup> | >1 7/8" | Standard <sup>2</sup> | Pickouts             | Gravity  | Dec. <sup>5</sup> | Jan. <sup>6</sup> |   |
| Maris Piper*                   | 469                        | 382     | 133                   | 9                    | 1.094    | 0                 | 0                 | 1 |
| AAF10237-4*                    | 374                        | 334     | 116                   | 6                    | 1.106    | 0                 | 0                 | 0 |

<sup>1</sup> Yield Total = all yield including pickouts. Yield >1 7/8" = categories 2, 3, 4 and 5 excluding pickouts.

<sup>2</sup> Percentage of the standard, Russet Norkotah for >1 7/8" yield.

<sup>3</sup> Percentage of total that are pickouts.

<sup>4</sup> French Fry Color: USDA Scale Color Standers for Frozen Fried Potatoes with 000 = lightest, 4 =

darkest.

<sup>5</sup> Dec. = Stored at 55°F from November 19, 2015 and fried on December 10 & 14, 2015.

<sup>6</sup> Jan. = Stored at 45°F from November 29, 2015 than transferred to 55°F three weeks prior to frying on January 26 & 27, 2016.

<sup>7</sup> Feb. = Stored at 45°F from November 29, 2015 than transferred to 55°F six weeks prior to frying on February 16 & 17, 2016.

Replicated trials are the average of 3 replicates except for those lines with \* which were non-replicated.

<sup>YF</sup> = Yellow flesh

Table 2. Total yield, greater than 1 7/8" yield, specific gravity, and French fry color for russet skinned or long white potato evaluation trial in Lehigh County, Forrest Wessner Farm, 2015 - 2016.

| Variety/<br>Color <sup>4</sup><br>Line | Yield (cwt/A) <sup>1</sup> |         | % of                  | Percent <sup>3</sup> | Specific | French Fry        |                   |    |
|--|----------------------------|---------|-----------------------|----------------------|----------|-------------------|-------------------|----|
|  | Total                      | >1 7/8" | Standard <sup>2</sup> | Pickouts             | Gravity  | Dec. <sup>5</sup> | Jan. <sup>6</sup> |    |
|  | Feb. <sup>7</sup>          |         |                       |                      |          |                   |                   |    |
| Atlantic                               | 358                        | 302     | 100                   | 13                   | 1.087    | -                 | -                 | -  |
| Performer * <sup>YF</sup>              | 343                        | 274     | 91                    | 17                   | 1.073    | 1                 | 1                 | 1  |
| Ambassador * <sup>YF</sup>             | 407                        | 232     | 77                    | 25                   | 1.084    | 1                 | 1                 | 1  |
| Fontane * <sup>YF</sup>                | 397                        | 297     | 98                    | 7                    | 1.082    | 1                 | 1                 | 1  |
| Easton *                               | 434                        | 365     | 121                   | 12                   | 1.081    | 0                 | 00                | 00 |
| Russet Norkotah *                      | 287                        | 226     | 75                    | 14                   | 1.066    | 2                 | 1                 | 1  |
| Dakota Trailblazer *                   | 308                        | 205     | 68                    | 25                   | 1.095    | 0                 | 00                | 00 |
| Norwis *                               | 295                        | 279     | 92                    | 0                    | 1.063    | 0                 | 1                 | 0  |
| Cal White *                            | 421                        | 347     | 115                   | 14                   | 1.076    | 1                 | 1                 | 1  |
| Bentje * <sup>YF</sup>                 | 357                        | 158     | 52                    | 35                   | 1.070    | 0                 | 0                 | 0  |
| Lady Amarilla * <sup>YF</sup>          | 312                        | 236     | 78                    | 12                   | 1.073    | 1                 | 1                 | 1  |

<sup>1</sup> Yield Total = all yield including pickouts. Yield >1 7/8" = categories 2, 3, 4 and 5 excluding pickouts.

<sup>2</sup> Percentage of the standard, Atlantic for >1 7/8" yield.

<sup>3</sup> Percentage of total that are pickouts.

<sup>4</sup> French Fry Color: USDA Scale Color Standers for Frozen Fried Potatoes with 000 = lightest, 4 = darkest.

<sup>5</sup> Dec. = Stored at 55°F from November 19, 2015 and fried on December 9, 2015.

<sup>6</sup> Jan. = Stored at 45°F from November 29, 2015 than transferred to 55°F three weeks prior to frying on January 26, 2016.

<sup>7</sup> Feb. = Stored at 45°F from November 29, 2015 than transferred to 55°F six weeks prior to frying on February 16, 2016.

Non – replicated trial.

<sup>YF</sup> = Yellow flesh

\*= Russets and long whites were planted 10-in. apart with 24 seed pieces per 20-ft plot, Atlantic were spaced 8-in. apart with 30 seed pieces per 20-ft plot.

Table 3. French fry color results of potato evaluation in Erie County, Mark Troyer Farm, 2015 - 2016.

| Variety/<br>Line            | Specific<br>Gravity | <u>French Fry Color<sup>1</sup></u> |                   |                   |
|-----------------------------|---------------------|-------------------------------------|-------------------|-------------------|
|                             |                     | Dec. <sup>2</sup>                   | Jan. <sup>3</sup> | Feb. <sup>4</sup> |
| Dione <sup>YF</sup>         | 1.068               | 0                                   | 1                 | 0                 |
| Performer <sup>YF</sup>     | 1.062               | 1                                   | 1                 | 1                 |
| Ambassador <sup>YF</sup>    | 1.073               | 1                                   | 1                 | 1                 |
| Fontane <sup>YF</sup>       | 1.074               | 1                                   | 1                 | 1                 |
| Easton                      | 1.072               | 0                                   | 00                | 00                |
| Russet Norkotah             | 1.059               | 0                                   | 1                 | 1                 |
| Dakota Trailblazer          | 1.081               | 0                                   | 0                 | 0                 |
| Norwis                      | 1.062               | 1                                   | 1                 | 1                 |
| Cal White                   | 1.066               | 2                                   | 1                 | 1                 |
| Bentje <sup>YF</sup>        | 1.064               | 1                                   | 1                 | 0                 |
| Lady Amarilla <sup>YF</sup> | 1.071               | 1                                   | 1                 | 1                 |

<sup>1</sup> French Fry Color: USDA Scale Color Standers for Frozen Fried Potatoes with 000 = lightest, 4 = darkest.

<sup>2</sup> Dec. = Stored at 55°F from November 19, 2015 and fried on December 9, 2015.

<sup>3</sup> Jan. = Stored at 45°F from November 29, 2015 than transferred to 55°F three weeks prior to frying on January 26, 2016.

<sup>4</sup> Feb. = Stored at 45°F from November 29, 2015 than transferred to 55°F six weeks prior to frying on February 16, 2016.

<sup>YF</sup> = Yellow flesh

Table 4. Total yield, greater than 1 7/8" yield, specific gravity, and French fry color for potato commercial trials of four varieties in 2015 - 2016 at: A) Erie County, Kevin Troyer Farm; B) Schuylkill County, Red Hill Farm; C) Rock Springs, Plant Pathology Farm. 200 lbs of each variety were planted in each location.

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| Color <sup>4</sup>  | Variety/<br>Line<br>Feb. <sup>7</sup> | Yield (cwt/A) <sup>1</sup> % of |         |                       | Percent <sup>3</sup> | Specific Gravity | French Fry        |                   |    |
|---|---------------------------------------|---------------------------------|---------|-----------------------|----------------------|------------------|-------------------|-------------------|----|
|   |                                       | Total                           | >1 7/8" | Standard <sup>2</sup> | Pickouts             |                  | Dec. <sup>5</sup> | Jan. <sup>6</sup> |    |
| Kevin Troyer Farm   | Dakota Trailblazer                    | 305                             | 279     | 105                   | 4                    | 1.106            | 0                 | 0                 | 0  |
|   | Cal White                             | 423                             | 351     | 133                   | 14                   | 1.091            | 0                 | 0                 | 0  |
|   | Norwis                                | 287                             | 264     | 100                   | 4                    | 1.074            | 0                 | 0                 | 1  |
|   | Bintje <sup>YF</sup>                  | 317                             | 237     | 90                    | 6                    | 1.085            | 1                 | 1                 | 1  |
|   | Lady Amarilla <sup>YF</sup>           | 254                             | 226     | 85                    | 2                    | 1.082            | 1                 | 1                 | 1  |
|   | Performer <sup>YF</sup>               | 273                             | 257     | 97                    | 0                    | 1.074            | 1                 | 1                 | 1  |
|   | Ambassador <sup>YF</sup>              | 314                             | 240     | 91                    | 4                    | 1.095            | 1                 | 1                 | 1  |
| Red Hill Farm   | Dakota Trailblazer                    |                                 |         |                       | 268                  | 221              | 62                | 15                |    |
|   | 1.105                                 | 0                               | 0       | 0                     |                      |                  |                   |                   |    |
|   | Cal White                             | 372                             | 323     | 90                    | 9                    | 1.085            | 0                 | 0                 | 0  |
|   | Norwis                                | 380                             | 358     | 100                   | 2                    | 1.074            | 0                 | 0                 | 0  |
|   | Bintje <sup>YF</sup>                  | 362                             | 245     | 69                    | 17                   | 1.074            | 1                 | 1                 | 1  |
|   | Lady Amarilla <sup>YF</sup>           | 301                             | 244     | 68                    | 10                   | 1.073            | 1                 | 1                 | 1  |
|   | Performer <sup>YF</sup>               | 427                             | 362     | 101                   | 8                    | 1.077            | 1                 | 1                 | 1  |
| Rock Springs  | Ambassador <sup>YF</sup>              | 452                             | 374     | 105                   | 0                    | 1.089            | 1                 | 1                 | 1  |
|   | Dakota Trailblazer                    | 374                             | 347     | 76                    | 5                    | 1.104            | 00                | 0                 | 0  |
|   | Easton                                | 402                             | 363     | 80                    | 5                    | 1.088            | 00                | 00                | 00 |
|   | Cal White                             | 437                             | 337     | 74                    | 21                   | 1.080            | 0                 | 0                 | 1  |
|   | Norwis                                | 476                             | 455     | 100                   | 3                    | 1.081            | 00                | 00                | 0  |
|   | Bintje <sup>YF</sup>                  | 356                             | 282     | 62                    | 7                    | 1.085            | 1                 | 1                 | 0  |
|   | Lady Amarilla <sup>YF</sup>           | 367                             | 306     | 67                    | 4                    | 1.083            | 1                 | 1                 | 1  |
|   | Performer <sup>YF</sup>               | 362                             | 322     | 71                    | 8                    | 1.080            | 1                 | 1                 | 1  |
|   | Ambassador <sup>YF</sup>              | 383                             | 314     | 69                    | 8                    | 1.091            | 1                 | 1                 | 1  |
| <sup>1</sup> Yield Total = all yield including pickouts. Yield >1 7/8" = categories 2, 3, 4 and 5 excluding pickouts.<br><sup>2</sup> Percentage of the standard, Norwis for >1 7/8" yield.<br><sup>3</sup> Percentage of total that are pickouts.<br><sup>4</sup> French Fry Color: USDA Scale Color Standers for Frozen Fried Potatoes with 000 = lightest, 4 = darkest.<br><sup>5</sup> Dec. = Stored at 55°F from November 19, 2015 and fried on December 8 & 9, 2016.<br><sup>6</sup> Jan. = Stored at 45°F from November 29, 2015 than transferred to 55°F three weeks prior to frying on January 28, 2016. |                                       |                                 |         |                       |                      |                  |                   |                   |    |

<sup>7</sup> Feb. = Stored at 45°F from November 29, 2015 than transferred to 55°F six weeks prior to frying on February 18, 2016.

<sup>YF</sup> = Yellow flesh

Planting spacing for trial

Kevin Troyer    Dakota Trailblazer - 12 inches  
                          Cal White - 12 inches  
                          Norwis- 12 inches  
                          Bintje <sup>YF</sup> - 12 inches  
                          Lady Amarilla <sup>YF</sup> – 12 inches  
                          Performer <sup>YF</sup> – 12 inches  
                          Ambassador <sup>YF</sup> – 12 inches

Table 4. Continued.

Red Hill Farm    Dakota Trailblazer - 12 inches  
                          Cal White - 12 inches  
                          Norwis- 12 inches  
                          Bintje <sup>YF</sup> - 12 inches  
                          Lady Amarilla <sup>YF</sup> – 12 inches  
                          Performer <sup>YF</sup> – 12 inches  
                          Ambassador <sup>YF</sup> – 12 inches

Rock Springs    Dakota Trailblazer - 12 inches  
                          Easton – 12 inches  
                          Cal White - 12 inches  
                          Norwis- 10 inches  
                          Bintje <sup>YF</sup> - 10 inches  
                          Lady Amarilla <sup>YF</sup> – 10 inches  
                          Performer <sup>YF</sup> – 10 inches  
                          Ambassador <sup>YF</sup> – 10 inches

**Table 5.** Par-fry test of eight varieties from potato commercial trial in in 2016. The test was performed by KPP.

| Potato Grower | Variety   | Specific Gravity | Temperature | Start Weight | Post Blanch Weight | Post Drying Weight | Post Par-Fry Weight | Final Fry Time | Zach | Mark Moyer | Glenn |
|---------------|-----------|------------------|-------------|--------------|--------------------|--------------------|---------------------|----------------|------|------------|-------|
| Red Hill      | Performer | 1.076            | 51.0        | 5.00         | 5.06               | 4.50               | 3.22                | 1:15           | 1    | 1          | 3     |

|          |                    |       |      |      |      |      |      |               |    |    |     |
|----------|--------------------|-------|------|------|------|------|------|---------------|----|----|-----|
| Red Hill | Ambassador         | 1.089 | 50.7 | 5.00 | 5.16 | 4.64 | 3.32 | 1:15          | 2  | 1  | 2   |
| Red Hill | California White   | 1.079 | 51.0 | 5.00 | 5.04 | 4.58 | 3.22 | 1:15 + 30 sec | 4  | 4  | 4   |
| Red Hill | Bintje             | 1.076 | 51.0 | 5.00 | 5.20 | 4.70 | 3.40 | 1:15          | 5  | 5  | 5   |
| Red Hill | Lady Amarillo      | 1.075 | 50.9 | 5.00 | 5.00 | 4.48 | 3.20 | 1:45          | 6  | 6  | 6   |
| Red Hill | Dakota Trailblazer | 1.120 | 51.0 | 5.00 | 5.22 | 4.68 | 3.42 | 1:45          | 3  | 1  | 1   |
| Red Hill | Norwis             | 1.074 | 51.0 | 5.00 | 5.24 | 4.68 | 3.44 | 1:45          | 1A | 1A | N/A |
| PSU      | Easton             | 1.093 | 50.9 | 5.00 | 5.34 | 4.80 | 3.54 | 1:45          | 1B | 1B | N/A |

**Table 6.** List of educational presentations and contacts on par fry potatoes.

October 2014 meeting held at KPP to identify needs for par fry work.

January 7, 8, 9, 2015 Potato Expo Identified potential potato varieties for Par Frying, met with seed growers.

February 29, 2015 Mid Atlantic Vegetable Conference, what is Par Frying?

March 4, 2015, Lehigh Valley Potato Day, what is Par frying?

March 17, 2015 test kitchen at KPP preliminary par-fry testing.

August 2015 Ag Progress Days Penn State Potato Exhibit included Par Fry exhibit.

September 8, 2015, Lehigh Valley Twilight Potato field meeting, Flint Hill Farm, Par Fry Update.

September 10, 2015 Erie Potato Field Meeting Par Fry update.

February 4, 2016 Mid-Atlantic Vegetable Conference Par Frying Potatoes.

Feb and March, 2016, Potato samples par fried at KPP.

March 2, 2016 Lehigh Valley Potato Day, Par fry Potato SCBG grant update.

August 16, 17, 18, 2016, Ag Progress Days variety trial and Potato tent, Par fry potatoes!

Sept 8, 2016 Erie Potato Field meeting; Par fry update.

Sept 20, 2016 Lehigh Valley Potato Twilight Field Meeting, Country View Farm, Par Fry Update.

**Photo 1.** A photo shows par fry colors of eight par fry varieties after par frying processing in KPP in 2016.



**Photo 2.** Par fry varieties were shown to potato growers at Country View farm potato field meeting 2016.





### Project 3

### Improving Tomato Profitability through Refining Foliar Nutrition Applications

#### Project Summary:

Fresh market tomatoes are the highest value per acre vegetable crop grown in PA and the Mid-Atlantic. A single acre's value can gross at \$90,000 or more. As such, even relatively small improvements in yield and crop quality can increase farm-gate revenues substantially. Improving nutrition programs directly reduce packing house and field losses due to Blossom End Rot, Cracking and Yellow Shoulders disorders.

There is currently a substantial gap between the recommendations provided by commercial fertilizer manufacturers and University researchers when it comes to foliarly applied nutrients. This is especially so in tomato recommendations. This researcher has experienced substantive results using foliar nutrients in a coordinated program with injected (fertigated) nutrients. University researchers have often used laboratory reagents where the manufacturers use a variety of organic chelates, surfactants and other adjuvants in addition to the actual minerals in order to move nutrients across the plant leaves cuticle or into stomata.

As drip irrigation has become standard practice due to the ability to add nutrients during the growing season and use substantially less water than overhead irrigation, high-yielding tomatoes often run short of critical nutrients such as Ca, Mg, B and K even under heavy



|                              |  |
|------------------------------|--|
|                              | <p>fertigation. The ability to provide some additional nutrients at critical times through foliar application could greatly improve packout and profitability. The big questions with foliar nutrients are: Do they work? When should they be used? And, How much actually moves into plant tissue? This program examined various combinations of foliar nutrients, timing of application and use washed-leaf tissue analysis to determine plant uptake.</p> <p>Partner organizations include: 1) The Penn State Southeast Agricultural Research and Extension Center (SEAREC), Manheim, PA. SEAREC will provide a heated high tunnel to house the project. 2) Agri-Analysis, Leola, PA. Agri-Analysis has modern soil, tissue and fruit slurry testing equipment and provided all of the analysis's for this project.</p>   |
| Goals and Outcomes Achieved: | <p>We planted 3 rows of Bush Early Girl determinate round red slicing tomato plants in #2800 nursery pots and installed a 'spaghetti-type' irrigation / fertigation system to provide water and soil applied nutrients in a 17' x 48' heated high tunnel at the PSU SEAREC. The plants were installed on April 14, 2015 (see the attached image of the plants at installation). All plants were constant fed a nutrient solution six days on and one day off when we irrigated with clear water to prevent the buildup of nutrient-derived salts. Insect and disease management were provided equally to all treatments on a weekly basis.</p> <p>We divided the plants into blocks of 4 (4 plants per plot) with 3 replications. Foliar nutrients were applied on the following dates:</p> <p>June 2, 2015<br/>         June 12, 2015<br/>         June 22, 2015<br/>         July 2, 2015<br/>         July 10, 2015<br/>         July 20, 2015<br/>         July 30, 2015<br/>         August 11, 2015<br/>         August 21, 2015</p> <p><b>Below are the treatments and rates used:</b><br/>         MgSO<sub>4</sub> (Epsom salts) at 1T per gallon<br/>         Spray Mg (10%Mg) at 75ml per gallon<br/>         MagSi (5%Mg + Potassium Silicate) at 1t per gallon<br/>         NutriCal (Calcium carbonate + surfactants) at 30 ml per gallon<br/>         Magical (blend of Ca and Mg from TIMAC) at 60 ml per gallon<br/>         4-10-40 (Miller Chemical product designed for foliar application) at 1T per gallon<br/>         NutriK (Potassium sulfate + surfactants) at 35 ml per gallon<br/>         Corona K (39% potassium from TIMAC) at 48g/ gallon<br/>         Water control<br/>         Note: all of the above rates came from the various manufacturers or Knott's Handbook for Vegetable Growers 6<sup>th</sup> Ed.</p> |

|               |   |
|---------------|---|
|               | <p>All foliar nutrients were applied just to the point of complete coverage of the foliage and fruit (when present), but not so much as to cause dripping into the root zone. One of the long held beliefs about foliarly applied nutrients is that most of the benefit comes from rain or irrigation water washing the nutrients off of the fruit and foliage and into the root zone.</p> <p>Foliarly applied potassium appeared to make the most difference in overall yield, tissue and fruit slurry analysis. In this program foliarly applied magnesium and calcium seemed to show only minimal results. However, this researcher has often found that when plants are deficient, the combination of foliar and injected Mg and Ca improves tomato plants overall production and tissue levels substantially faster than fertigated nutrients alone. It is also obvious that formulation matters; Ca chelates, Mg chelates and K formulations that are designed to better cross the cuticle barrier or move through the plant stoma work better and faster.</p>  |
| Beneficiaries | <p>Specialty vegetable growers (tomatoes, peppers, eggplant, cucumbers, melons...) will benefit from this information. Having the ability to effectively foliarly apply small quantities of specific nutrients to meet unexpected plant demands has the opportunity to improve packout (percentage of fruit that are saleable vs. composted), improve shelf life and even impact flavors positively.</p> <p>Articles based on the results of this project will be published in the PSU Vegetable Gazette with electronic and paper versions that go to over 3,700 readers, and The PA Vegetable Growers Association magazine with just under 1,000 members. These articles are typically picked up and reprinted in many NE, Mid-Atlantic and Upper Midwest similar publications.</p> <p>Two grower presentations are presently scheduled where the results of this project will be featured: 1) NE Vegetable Growers Meeting, NH on 12/17/2015 and, 2) Mid-Atlantic Fruit and Vegetables Growers Conference and Trade Show on 2/3/16. Both sessions typically draw in excess of 350 growers each. This power point and proceedings article will be provided as a supplemental report once completed before 12/16/15.</p> <p>This project was part of the PA Vegetable Growers annual summer field day at the PSU SEAREC on 8/5/15. Due to the unsettled nature of agreement on foliarly applied nutrients, the 117 participants expressed a great deal of interest in the results of the project.</p> <p>Abiotic disorders of tomatoes such as yellow shoulders, Mg and Ca deficiencies cost growers substantial income annually as fruit is either downgraded from #1 or culled from marketing. With a potential gross income of \$90,000 per acre of tomatoes (\$56,000 is a better more conservative number), even improving pack out by 5% can greatly impact a grower's profitability. The latest USDA statistics have fresh market tomato production in PA at 796 acres (30% of the total tomato acreage which includes processing tomatoes). A 5% improvement is worth \$2,228,800.00 just to PA tomato growers. If you factor in the potential overlap with melons, cucumbers, peppers and other high value crops and that this information is applicable to the entire Mid-Atlantic, NE and Midwest, the actual impact of improving nutrition reaches truly astronomical numbers.</p> |

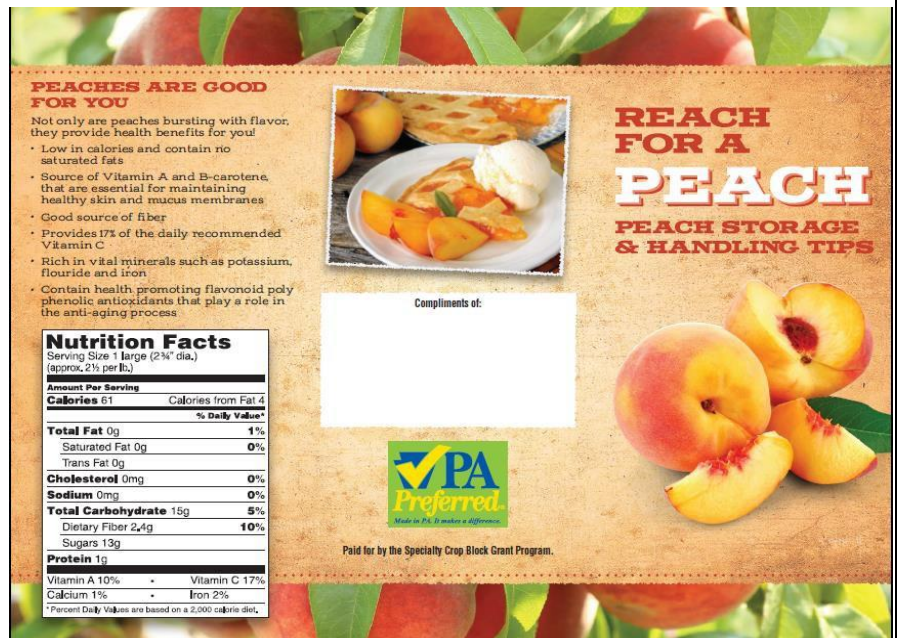
|                  |  |
|------------------|--|
| Lessons Learned: | n/a  |
| Contact Person:  | Steve Bogash, Commercial Horticulture Educator<br>717-240-6500 ext. 6507<br><a href="mailto:Smb13@psu.edu">Smb13@psu.edu</a>   |
|                  |  |
| <b>Project 4</b> | <b>Peach Nutrition &amp; Promotion Campaign - Year 2</b>   |
| Project Summary: | <p>The 2014 grant provided funding to increase consumer awareness and consumption of local and regionally produced peaches and the nutrient and dietary value through promotion/display materials targeted to direct marketers but applicable to retail sales organizations for the 2015 peach crop. The Pennsylvania peach industry begins their harvest and marketing of peaches at least two months after key peach producing regions have started marketing their crop. By that point in time, the market is reaching its saturation level. The availability of promotional materials to create greater awareness of locally/regionally produced peaches assists in the sales and marketing efforts for both the direct and retail markets.</p> <p>During the first year, the tool box of marketing and merchandising materials focused on the direct market sales audience and customers. While highly successful, post program evaluations indicated that there were numerous elements that would assist with increasing sales and educating the consumer on peaches. Those components or elements were built into the 2014 program that would be used to market the 2015 crop.</p> <p>Additionally, the marketers that focus on the retail side of sales indicated that as with the direct marketers, there was a need to reach out to the consumer and it was determined and submitted that a retail display contest would encourage the purchases, displays and use of peach promotional materials in the retail supermarkets would be an excellent tool to increase consumer awareness and consumption.</p> <p><b>OBJECTIVES:</b></p> <ul style="list-style-type: none"> <li>• Offer a tool box of items that industry growers and marketers may use that are most effective with the targeted market segments - retail and direct market <ul style="list-style-type: none"> <li>○ Proposed items included merchandising materials and display contests for the retail trade.</li> </ul> </li> <li>• Create greater consumer awareness of locally produced peaches and the contribution to the local community.</li> </ul> |

Project Approach:

To determine what new peach nutrition research findings published, an on-line search was conducted. It revealed no new findings thus, the only nutrition references would be those that USDA has published.

USDA nutrition facts used were published on the updated, full-color, tri-fold **PEACH Storage & Handling Tips** flyer for consumers. The flyer provided space for each marketer to stamp or identify their operation as the

provider of the flyer. Nearly 25,000 flyers were distributed; almost double the 2014 volume distributed.



Actual samples submitted with print version of the report and a pdf file of the flyer will be attached with the electronic version of the report.

Here's what the consumers thought of the flyer...

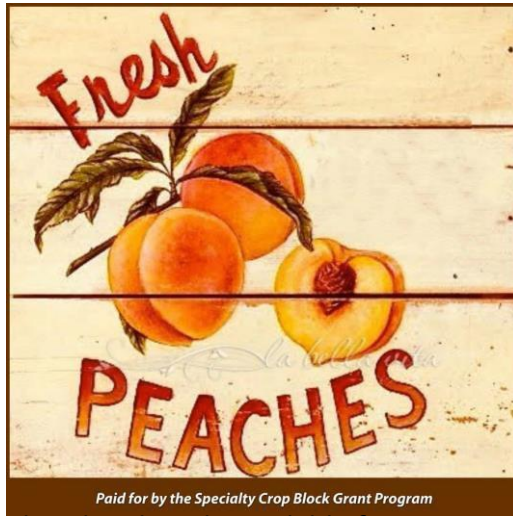
1. Consumers loved it!
2. Great product, consumers loved them.
3. Great!

News stories on peach

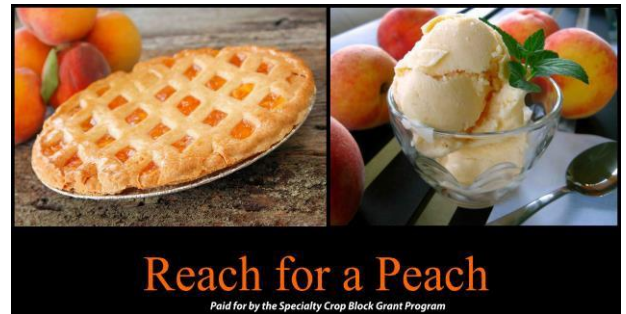
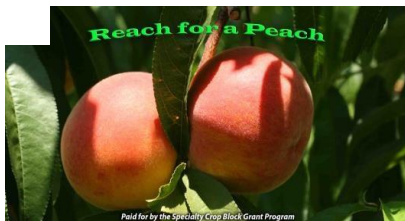
nutrition were not generated due to limited peach nutrition research being available.



Because the vinyl **Banners** that were created in the first year were designed to be used multiple years and the fact that they received high evaluation grades, the banners were re-



ordered and made available for distribution to the industry. Peach marketers could choose from five different vinyl banners designed and produced. The most popular was the “Fresh Peaches” banner however; the others were chosen and used in various locations of direct markets.



In the post promotion surveys, the marketers reported the following on the banners:

1. The Banners really made our peach display attractive and eye catching!
2. All the banners were great!
3. GREAT Fresh Peaches Banner.
4. All the banners gave an improved look to our market. We hung some inside the market which enticed our peach buyers! The ones we hung outside our market were highly visible from the road. THUMBS UP! Added to the Peach Marketing TOOL BOX

were **Recipe Tear Pads** that featured four different easy to prepare recipes:

- Grilled Peaches,
- Easy Peach Pie,
- Fresh Peach Salsa, and
- Peach Slush.



Markets provided these for the consumer to take

home and provide some additional ideas for adding peaches to their diets. Nearly 48,000 recipes were provided to the markets for consumer distribution. +

Comments from the survey included:

Consumers loved these!  
Consumers LOVED them!  
Need different recipes each year

These were a huge hit at our roadside market!  
Great artwork & ideas.  
GREAT! My customers LOVED them!

### 1/2 Peck Tote



Another NEW component was the addition of a generic 1/2 **PECK Peach Tote** for marketing and selling peaches. 25,000 totes were ordered from the supplier however 27,500 were received at no extra charge. The totes were SO successful that even when all the totes were distributed, we were receiving calls for additional totes.

Survey comments included:

1. Perfect for our farmer's market
2. Great product, consumers loved them.
3. These were very trendy and people liked buying peaches this way – THANKS!
4. Customers REALLY liked the totes!

When ordering totes, a minimum of 25,000 is required. Because this number is so large, it would take a single market 5 to 8 years to use the volume. Thus, the addition of the tote to the tool box allowed markets to use it without buying years of

inventory and investing money with minimal return. This element of the promotional grant definitely filled a void.

All industry member participants of the Pennsylvania Peach & Nectarine Research Program received a direct mail piece regarding the availability of these materials. Additionally, availability of the promotional materials occurred in a story and order form appearing in the May 2015 issue of the State Horticultural Association of Pennsylvania's (SHAP) **FRUIT NEWS**. This publication is sent to SHAP members and most of Pennsylvania's commercial fruit producers are members of SHAP.

A series of three videos were produced that educate consumers and address marketing needs for Pennsylvania Peach producers and market owners. Videos covered peach varieties and their uses, food safety, and proper handling and storage techniques in the market.

Videos were provided in digital format and via digital media to owners of roadside stands, farm market owners and farmers markets throughout Pennsylvania as well as to Pennsylvania peach producers via email or postal mail.

#### Videos:

##### Peach Varieties & Uses

- Audience: Consumers
- Educational

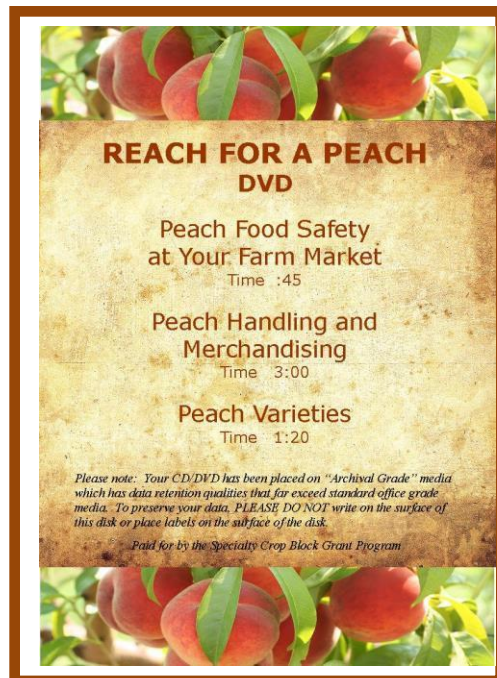
Topics: How to identify and use freestone or cling stone peaches, varieties and uses for Pennsylvania consumers

##### Food Safety

- Audience: Consumers
- Educational Topics: Food Safety precautions taken by growers to keep PA Peaches safe and ready to consume for PA consumers

##### Merchandising and Storage

- Audience: Farm Market Owners, Managers and Staff
- Educational Topics: Best management practices for storage, holding, and merchandising PA Peaches for best quality.



The online link is as follows:

- <https://drive.google.com/folderview?id=0B8SP0uJPRecHfno0QnRQdHRubk5EdlduaERyV3MtcXVXZEg0VDBwRnpacmhnaXZOWmZVVkk&usp=sharing>



Because the videos were being produced throughout the season, based upon the need to obtain footage, the actual videos were not available until the very end of the marketing season so actual use was limited. However, the industry members have both a DVD and web-based links of the videos for next year's marketing season.

The videos were produced in conjunction with Penn State Cooperative Extension Service of Adams County, PA.

While the grant was written and awarded with a retail display contest for the trade, it was later determined that the use of grant funds may not be permitted since the funds would not be spent directly with the consumer.

As a result, the PA Department of Agriculture approved the redirection of funds to a **Consumer Recipe Contest**. As with the video, the Penn State Cooperative Extension Service was used to create, coordinate, and produce the recipe contest. Using the database of the PA Peach & Nectarine Research Program, the 2014 Reach for a Peach Promotion participants and the 2015 Reach for a Peach Promotion participants, the contest was promoted to industry members for delivery to their consumers.

**The purpose of this contest was to promote the use of Pennsylvania Peaches in both sweet and savory new dishes. Participants were recruited via print, email and in person marketing materials.**

Impacts:

- Increased awareness of PA Peach uses and varieties
- Increased knowledge of sweet and savory recipes to use PA Peaches.

Contest delivery tools the markets could use to direct consumers on how to enter included:

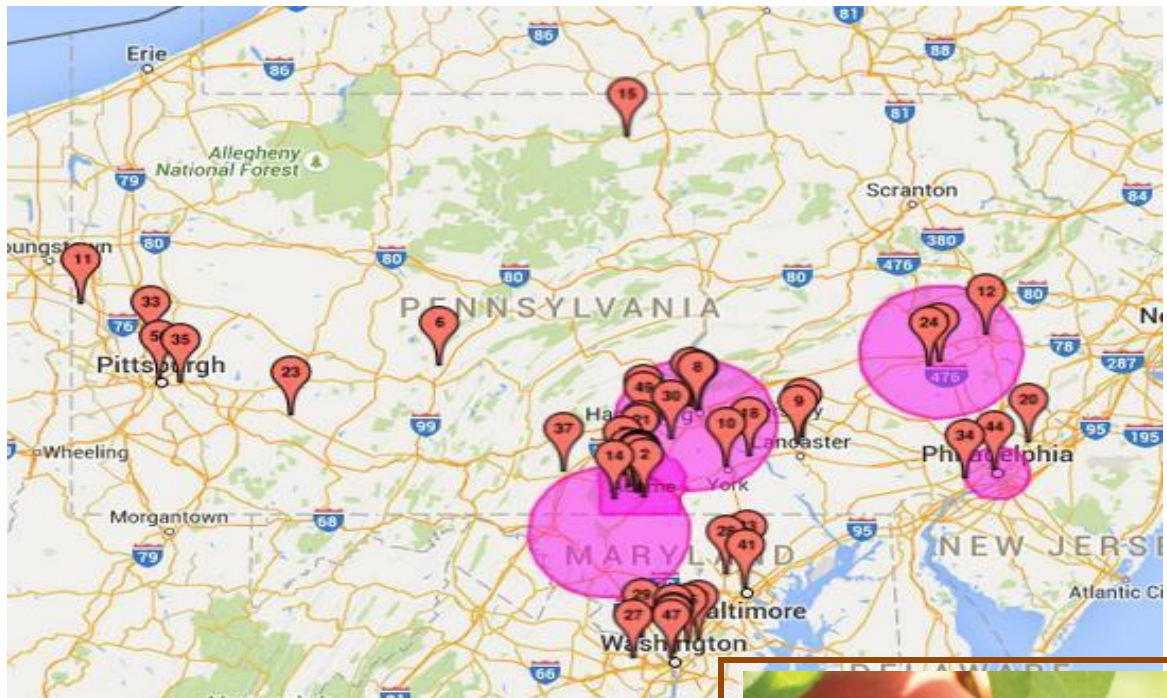




**Flyer**

**Postcards**

Distribution of Recipe Contest information to various markets is illustrated below:



Following a preliminary review of the recipes submitted, the judges narrowed the entrants down to four (4) finalists who were required to appear and actually prepare the recipe for final judging.

Judges for the contest were:

- Maria Wolf – Fidler & Co. Craft Kitchen, 213 E York St, Biglerville, PA 17307
- Ashlee Dugan – PA Dept. of Ag, Agricultural Marketing Development, 2301 North Cameron Street, Harrisburg 17110-9408
- Gabbie Crouse – FFA President, Northern York High School, 653 S Baltimore St, Dillsburg, PA 17019

The winners of the contest were:

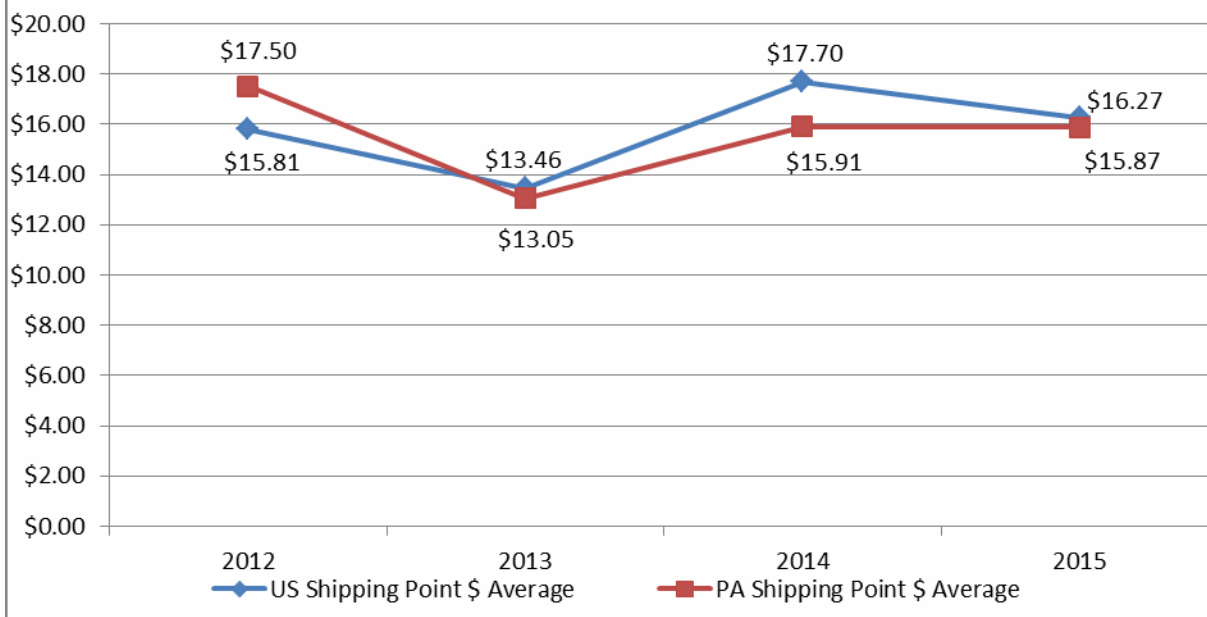
- SAVORY Division - Bridget Footit
- SWEET Division - Christine Heyser



|                                     |   |
|-------------------------------------|---|
|                                     | <p>Other finalist were: Sandra Miller and Gina Longhitano</p> <p>Finalist recipes are featured in a recipe flyer that will be used to promote peaches in the future.</p> <p><i>Lancaster Farming</i> provided press coverage of the event and a feature story.</p> <p>A mail survey was sent to all companies that used the promotional materials. The survey was completed by 27% of the companies and revealed that the promotional components provided through the Specialty Crop Block Grant Program to promote Pennsylvania Peaches in 2015 was a tremendous success and filled a void within the industry. Respondents evaluated the materials and provided insight for future marketing needs. A summary is attached as an addendum to this report.</p>  |
| <p>Goals and Outcomes Achieved:</p> | <p>The 2015 Pennsylvania peach marketing season provided the industry with numerous challenges; however, the ability to provide marketing materials to increase awareness and consumption of Pennsylvania’s local peaches proved to be a positive endeavor for the marketers.</p> <p>Overall, the domestic peach crop returned to more typical levels of production and timing. The southeast suffered from some early frost damage which delayed their entry into the market, while the west coast arrived nearly two-weeks earlier than normal. With the early entry, the market started strong, however, quickly stalled when the coolers in the west and the emergence of the southeast collided in mid-June. This was compounded by smaller than normal or optimal size fruit for the market.</p> <p>Another factor was the role that the retail trade played in pricing and movement. Typically, the retail trade features domestic peaches from the Memorial Day Holiday through July Fourth Holiday for \$.99/pound. This year, the retail leaders took the position of \$1.99/pound which further impacted consumer take-away in that fresh domestic peaches were considered less affordable. When the movement slowed, that put more pressure on the market to lower the price to move peaches, a highly perishable crop.</p> <p>Using USDA Market News Service to generate the illustrations below, Pennsylvania’s Overall Average Price at the Shipping Point were \$.04 less than the 2014 sales season but more than \$2.80 more than the 2013 Average Price. A positive lift to the average season selling price was our goal, however producer losses were minimized.</p> <p>The movement volume pattern followed typical Pennsylvania industry trends with the market spiking and then a steady decline as the volume and availability of peaches begins to diminish. Early 2015 peaches were available one week earlier than the 2014 or 2013 seasons. It took the industry seven-weeks to sell the crop, one week longer than 2014 but the same length of time as 2013.</p> <p>Weekly prices for Pennsylvania peaches started strong, as they do in most years, and dipped</p> |

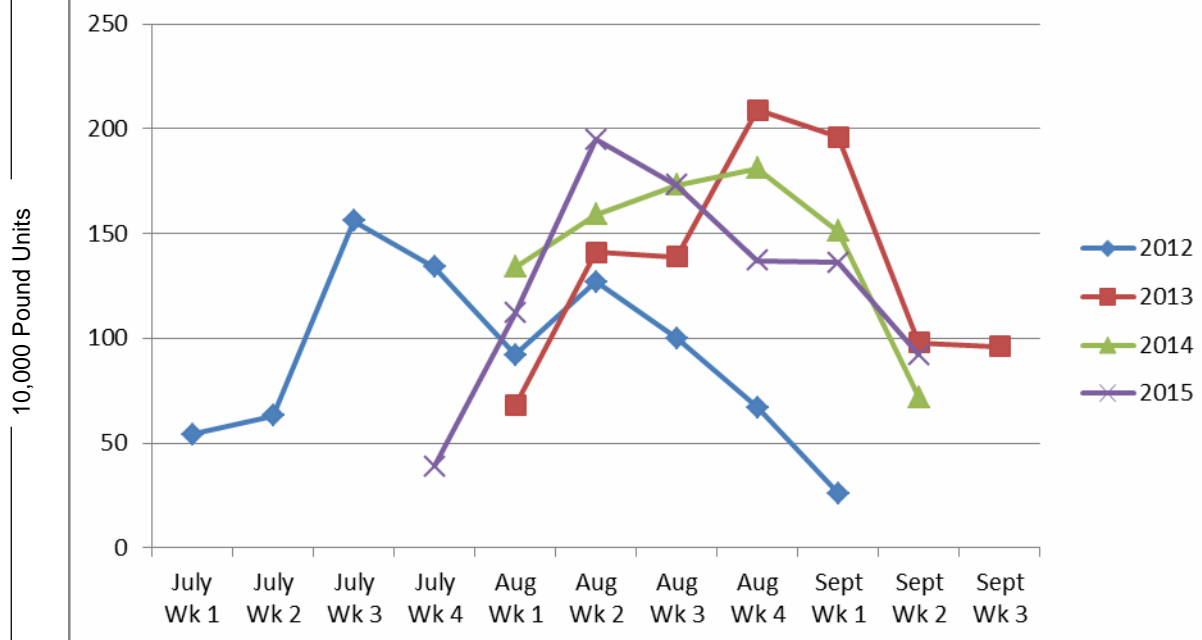
during the height of the season. The last week of shipping prices rebounded, however, the volume associated with those prices was minimal.

### 4-Year U.S. vs. Pennsylvania Shipping Point Overall Average Price



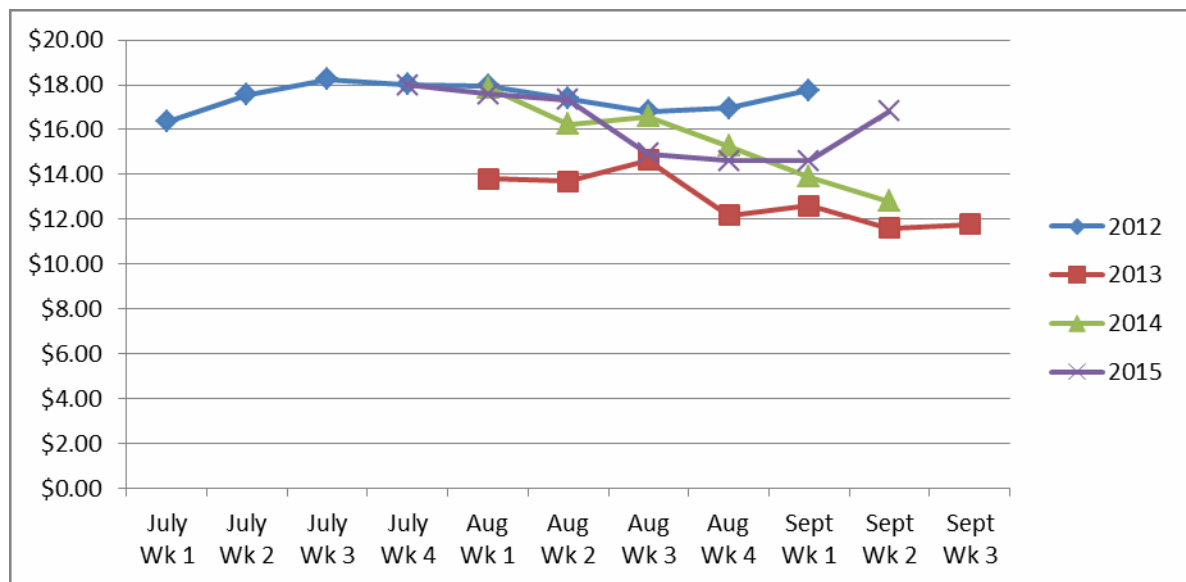
NOTE: Shipping Point Prices are FOB prices that represent open market sales by first handlers at point of production on product of generally good quality and condition. The overall prices combine all possible districts, varieties, packages and units until specific values for those criteria are selected.

### Pennsylvania Shipping Point 4-Year Weekly Peach Movement\*



\*Movement & pricing data from USDA Agricultural Marketing Service Commodity reporting based upon the state of Pennsylvania and the District of Appalachian.

### Pennsylvania Shipping Point 4-Year Weekly Average Peach Pricing\*



\*Movement & pricing data from USDA Agricultural Marketing Service Commodity reporting based upon the state of Pennsylvania and the District of Appalachian. All shipping point prices are f.o.b. prices that represent open market sales by first handlers at the point of production.

|                  |  |
|------------------|--|
|                  | <p>Final year volume and price reporting data will be available from USDA AMS in the spring of 2016. While the final production and utilization figures are not yet available from USDA, it is the consensus of the industry that this year's crop was a typical crop in size and of excellent quality.</p> <p>Throughout the season, growers provided feedback in telephone conversation and emails that noted how grateful they were to have innovative and attractive promotional tools and activities to create increased consumption and awareness with retailers, direct marketers and consumers. They noted that the consumers liked the "eye-catching" recipes and handling flyer and that they learned more about peaches than they knew before obtaining the items. The banners "caught my eye and I decided to stop at the market" was a frequent expression of the consumers.</p> <p>Direct or Farm Market operators really liked the addition of the ½ peck tote for merchandising and selling their peaches. The availability of the various merchandising and marketing tools provided much needed consumer education vehicles that they would not have been able to do as an individual operator. Additionally, the recipe contest provided an umbrella tool to engage the consumer that shopped in their markets and solicit additional uses for Pennsylvania peaches. The winning recipe flyer will be an excellent tool for marketing Pennsylvania peaches.</p> <p>Fifty percent more marketers made use of the tools available for marketing peaches in 2015, more than exceeding one of the goals of the promotional program.</p> <p>A long term goal is to increase consumer awareness and consumption which will be monitored for impact/achievement for the next 3-5 years to determine the consumer trend and accomplishment.</p> |
| Beneficiaries:   | <p>Peach producers and marketers in Pennsylvania benefitted from this project as it provided valuable marketing tools that previously were not available to the industry at an affordable price. Nearly 75 producers (50% more than the 2013 grant program) received the available materials to assist with the marketing of the 2015 season.</p> <p>USDA Agricultural Marketing Service reported that peaches shipped from PA averaged \$15.87 for all peaches sold between July 18 and September 30, 2015. This price was down \$.04 from last year but nearly 22 percent higher than the average selling price for the same time frame in 2013. Compared to the 2012 selling season, the price was down 9 percent.</p>  |
| Lessons Learned: | <p>The increased lead time and the use of the PA Peach &amp; Nectarine Research Program database allowed more effective out-reach to the industry. Additional industry out-reach occurred when a notice of promotional materials availability was published in the State Horticultural Association's <i>Fruit News</i>.</p> <p>Despite our efforts to identify new peach research, it is very limited. Nutrition value plays a key role in consumer education so research that identifies specific dietary benefits will be</p>  |

|          |   |
|----------|---|
|          | <p>encouraged for the future with researchers from various institutions.</p> <p>In the post-promotion survey, industry members noted that as the program moves forward, they would like to see some of following types of materials available:</p> <ol style="list-style-type: none"> <li>1. Peach educational materials targeted at elementary age students – coloring sheets that explain the various stages of peaches, ways to use peaches, etc.</li> <li>2. Re-useable shopping bag that promotes PA Peaches</li> <li>3. Pennsylvania Peach Facebook Page that would be updated throughout the year but especially during the production/harvest seasons. Would have the ability to link with commercial peach operations pages.</li> <li>4. Pennsylvania Peach Website that would be updated throughout the year but especially during the production/harvest seasons. Would have the ability to link with commercial peach operations pages.</li> </ol> <p>(Ranked in the order of importance, based upon surveys returned.)</p> <p>Additional comments and ideas included:</p> <ul style="list-style-type: none"> <li>• Something “Kid Friendly”</li> <li>• ½ peck and 1 peck boxes for merchandising</li> <li>• 4” x 6” Price Signs</li> <li>• Plastic bags with a simple peach logo – similar to plastic grocery bags</li> <li>• Canning/freezing directions/suggestions</li> <li>• Quart containers</li> <li>• More recipes</li> <li>• Table cloth decorated with peaches</li> <li>• Die-cut pictures of peaches or PDF/JPEG files we could feature in our e-newsletter</li> <li>• Peach variety information chart</li> </ul> <p>The switch from a retail display contest to a consumer recipe contest presented challenges due to the amount of planning and detail required to develop and execute a successful contest. The net result yielded great recipes that will be used in the future to promote Pennsylvania Peaches. The use of social media as the primary delivery vehicle for the contest was successful and effective in reaching the consumer.</p> <p>The additional consumer reach will be more effectively measured as per capita consumption is monitored in the future years, a measurement tool that is periodically published by USDA, however, peach marketers believe that the tools provided to them increased consumer knowledge of peach and in turn, should drive future sales as well.</p> |
| Contact: | <p>Kay Rentzel, National Peach Council</p> <p>Telephone Number: 717-329-8421</p> <p>Email Address: ksrentzel@aol.com</p>  |

|                              |  |
|------------------------------|--|
| <b>Project 5</b>             | <b>Keep Tasting on the Pennsylvania Wine Trails- The Ultimate Agritourism Experience</b>   |
| Project Summary:             | The Association created new and “shareable” content, recruited influential wine, food, and/or travel writers from in and around the Mid-Atlantic region to document two-day tours of PA wine regions. The PA Wines marketing team cultivated content by targeting mainstream press and influential followers to share the content with larger consumer audiences to generate visitor inquiries and sales. The promotion used a combination of web media, social media, blogs, email marketing, text message promotions, as well as partnership marketing with local tourism agencies and Agri-Tourism partners at the Department of Agriculture/PA Preferred.  |
| Project Approach:            | <p>The PWA worked directly with SWELL, a marketing firm, to arrange, organize the visits of the writers, the creation of the content and the promotion of the content. SWELL worked with Town Dish.com to execute the creation of the original content, recipes and photos. Activities and promotions related to the CROP Grant began in May 2016 and will continue into December 2016. In May we began with the promotion of National Wine Day and had feature in the TheBurg magazine, highlighting the Susquehanna River Valley winery/agri-tourism coverage. Additionally, Town Dish crafted original content on a PA Wines-inspired BBQ and Picnic Recipes. This original content, which featured PA wines and locally sourced ingredients, was promoted on Pennsylvaniawine.com and via our social media outlets from May through July.</p> <p>From August through October, TABLE Magazine (Pittsburgh) featured the Lake Erie Wine Country wineries/agri-tourism coverage and the PWA promoted the coverage. From August to September 2016, TownDish.com featured content on the PA Wilds wineries/agri-tourism coverage and Northeast Pennsylvania wineries/agri-tourism coverage. The PWA promoted the coverage during that same time to draw attention to the content and encourage visits. Beginning in October 2016, DrinkPhilly.com featured coverage on Lehigh Valley wineries/agri-tourism from a visit the blogger made earlier in 2016.</p> <p>Town Dish also executed the photographs and content related the “Meet the Winemaker” campaign released in October 2016. Planning and preparation of the materials took place in September 2016. The PWA promote the PA Wine Month “Meet the Winemaker” promotions in partnership with PLCB and PA Preferred.</p> <p>Lastly, Town Dish created PA Wines-inspired Fall recipes and content along with PA Wines and inspired Holiday recipes that were promoted from October 2016 to December 2016.</p> |
| Goals and Outcomes Achieved: | <p><b>GOALS AND OUTCOMES ACHIEVED:</b></p> <p>The goal of the project was to increase emerging Millennial consumer interest and visitation with PA wines and related Agri-tourism content marketing. The PWA sought out writers/ bloggers and mediums that reach the target audience to feature PA wines. The PWA also worked with SWELL and Town Dish to create content that featured PA wines and timely information for the season with targeted images.</p> <p>The reach and engagement with PA Wines consumers and influencers was achieved by using a combination of third party channels, social media advertising (Facebook, Twitter, and Instagram), email marketing, and public relations.</p> <p>Following are the results of the efforts of the project:</p> <ul style="list-style-type: none"> <li>Reached 162,000 potential PA wines customers and winery visitors as</li> </ul>   |

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|                  | <p>measured by digital marketing analytics, exceeding weekly reach goals by 165%.</p> <ul style="list-style-type: none"> <li>Generated 37,000 individual engagements in the form of content views and shares across web and social media environments, achieving an average cost-per engagement of \$0.81 based on the total \$30,000 total budget spend. This amount is up from the bench mark of an average reach of 250 weekly engagements from (March- November of 2014). <ul style="list-style-type: none"> <li>Total engagements exceeded the goal by 440%.</li> <li>Total new likes followers fell short of the 5,000 new fans/followers, but still increased by slightly more than 2,300 fans and followers. However, changes in social media advertising metrics are creating new and informative ways of understanding reach and engagement. Overall, the reach and engagement metrics exceeded goals and equaled a more efficient campaign.</li> </ul> </li> <li>Contributed a 17% increase (+2,067 visitors per month) in PA wines website visits during the course of the promotional period compared to 2015. <ul style="list-style-type: none"> <li>While the overall average increase during the promotional period fell short of goal by 4.6%, website visits were up significantly 27% during the heaviest promotional period (Jul – Aug).</li> </ul> </li> <li>Contributed 122 individual media coverage hits during the promotional period including original content developed through the program and shares of that content, exceeding our goal of 80 earned media placements.</li> <li>Based on available sales transactions reporting from 18 wineries through August 2016, the campaign is on target is to contribute a 7% increase or approximately 35,000 visitors to PA wineries statewide during the promotional period, exceeding our goal of 10,000 visitors.</li> </ul> |
| Lessons Learned: | <p>The specialty crop beneficiaries were the more than 220 Pennsylvania Wineries, winegrape growers, producers, and distributors. With nearly 14,000 grape bearing acres in Pennsylvania, this project showcased the locally grown grapes at wineries throughout the Commonwealth. Consumers also benefited from having an increased awareness and perceived accessibility to the local wines produced in Pennsylvania. Additionally, Pennsylvania Agri-tourism attractions and programs including farmers markets, farm-to-table restaurants, and related retailers through the PA Preferred program also benefited from the exposure alongside the wineries.</p>   |
| Beneficiaries:   | <p>The PWA was pleased by the increased traffic to the website and social media channels. In</p>   |



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|                  | <p>scheduling visits for writers to travel to regions of the state, we learned to be mindful of editorial calendars. For the future when working with writers/ bloggers we will take this into consideration.</p> <p>The PWA was pleased with the coverage in the metropolitan markets of Pittsburgh and Philadelphia. The extent of the coverage for the several publications was greater than initially anticipated.</p>  |
| Contact Person:  | <p>Jennifer Eckinger, Executive Director<br/>717-234-1844<br/>jeckinger@pennsylvaniawine.com</p>  |
|                  |   |
| <b>Project 6</b> | <b>PA Preferred Culinary Connection with focus on promoting Pennsylvania Specialty Crops</b>  |
| Project Summary: | <p>The PA Preferred Culinary Connection ranks among the most visited attractions of the Pennsylvania Farm Show. Over the course of eight days, the PA Preferred Culinary Connection hosts nearly 50 cooking demonstrations, with a focus on providing nutrition knowledge and showcasing the importance in consumption of Pennsylvania- sourced products and particularly specialty crops. Chefs from throughout Pennsylvania, TV Celebrity Chefs, and Culinary Schools educate the audience on the advantages of consuming specialty crops by incorporating such products into their recipes. Representatives from organizations such as the Pennsylvania Vegetable Growers, PA Apple Growers, PA Mushroom Institute, PA Co-Operative Potato Growers, PA Winery Association, PA Beekeepers Organization and PA Maple Syrup Producers directly participate in the stage demonstrations and hand out product samples and literature on local producers and the advantages of buying from Pennsylvania sources. Certain days are designated by a specific specialty crop, which becomes the main ingredient to be incorporated in all dishes prepared on our stage that day (For example, Mushroom Day, Vegetable Day, Apple Day, Potato Day etc.) Samples of each dish are prepared for audience members to taste in the conclusion of each demonstration. In addition, the PA Preferred Culinary Connection focuses on educating children and adults on healthy eating habits and food safety by demonstrating step-by-step food preparation while utilizing locally grown specialty crops.</p> <p>The importance of this project constitutes in the idea that it allows local farmers and food suppliers to showcase their specialty crops to local consumers; to educate the patrons on the health benefit to their families as well as the impact on their community's local economy by highlighting the quality and accessibility of those products; to reach out to the restaurant community and encourage Chefs to use Pennsylvania-sourced fruits, vegetables and herbs in their establishments; and to increase the overall demand for locally grown, sustainably produced specialty crops. By creating spectacular dishes on stage using local specialty crops, our demonstrating Chefs have educated consumers that they can prepare delicious meals at home by utilizing solely Pennsylvania fruits, vegetables and herbs.</p> <p>Specialty Crops commodity groups face the need to constantly find new ways to market their products and increase sales of those specialty crops products. The project fulfills those needs by allowing Specialty Crops commodity representatives from the Pennsylvania Vegetable Growers, PA Apple Growers, PA Mushroom Institute, PA Winery Association, PA Beekeepers Organization and PA Maple Syrup Producers to directly participate in the stage</p> |

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|                   | <p>demonstrations and hand out product samples and literature to the patrons. Their products are offered for purchase in close proximity to the PA Preferred Culinary Connection stage in the Main Expo Hall. Those specialty crop stakeholders directly benefit from this project as the PA Preferred Culinary Connection delivers immediate benefits to the specialty crops organizations and the local economy in the form of increased sales and marketability of PA commercially-grown specialty crops as it allows local farmers and food suppliers to showcase their specialty crops to local consumers.</p>   |
| Project Approach: | <p>The organization and management of the PA Preferred Culinary Connection with focus on promoting Pennsylvania Specialty Crops have largely followed the proven model while incorporating some additional elements, which we believe have further benefited the Pennsylvania Department of Agriculture in its effort to enhance the competitiveness of Pennsylvania's specialty crops. Our efforts have focused on fulfilling the purpose of the PA Preferred Culinary Connection with focus on promoting Pennsylvania Specialty Crops – to showcase and promote the use of Pennsylvania-sourced products and particularly specialty crops in preparing original dishes, increase consumer awareness of those locally grown products and highlight the quality and accessibility of specialty crops - while incorporating entertainment, flair and star talent in delivering this message.</p> <p>More than 537,000 estimated visitors came to the Farm Show this year to celebrate Pennsylvania Agriculture. Chefs from the most prominent farm-to-table restaurants in the area took the stage throughout the week to conduct cooking demonstrations and emphasize the importance of buying and using seasonal, locally grown specialty crops. They spread the message that “local food is fresher and it tastes better” and explained that sourcing ingredients from local farmers and producers is the way to go. To kick off the event on Saturday, January 10th, were Chefs from The Federal Taphouse, Stock's on Second, and Harvest Seasonal Grill &amp; Wine Bar, all embracing the farm-to-fork philosophy. Former White House Chef John Moeller made a special appearance and used local mushrooms to create two of his signature dishes. The annual Thermador Chefs Challenge was once again a huge hit! Two teams took the stage comprised of local Chefs and Media Celebrities. Local blogger Phoebe Canakis and Brandi Proctor, a traffic reporter for CBS 21 joined Mount Hill Tavern's Executive Chef Jason Clark and emerged as the winners at the end of the competition. The teams were given 30 minutes to make one dish using a blind bin of ingredients and a common pantry of food items. Pennsylvania grown hen-of-the-woods and oyster mushrooms, red peppers, parsley, and carrots, were among the blind bin ingredients and had to be featured in both team's final dishes. Both dishes were paired with local wines. The Star of “Big Daddy's House” on the Food Network, Aaron McCargo, Jr. created a ton of excitement at this year's event and won the audience with his contagious sense of humor, charm, high energy and culinary talent. On Sunday, he demonstrated how to prepare two of his signature salad dishes and stressed the importance of using fresh, local specialty crops. Chef Aaron gave a number of interviews and signed autographs for the fans in attendance. He also appeared on the abc27 Morning News promoting his appearance at the PA Preferred Culinary Connection later in the day. On Monday, Weis Day, we were honored to once again welcome on stage Walter Staib, Owner of the legendary City Tavern in Philadelphia &amp; host of the Emmy Award winning "A Taste of History." Chef Staib's appearance once again attracted a huge audience and close to 400 spectators lined up to get a taste of his French Lentil Salad.</p> |

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| <p>Goals and Outcomes Achieved:</p> | <p>The goal of this project is to encourage Pennsylvania citizens to select fresh, locally grown specialty crops when they shop and dine, by involving specialty crops organizations to directly market their products to the consumer, as well as utilize Chefs and TV Personalities in expanding the awareness and use of specialty crops, by which building a positive behavior for eating more nutritious food. The purpose of this project is to increase the sales of locally grown specialty crops through improving consumer awareness of specialty crop preparation. This increase in sales is documented through the daily sales records of the Pennsylvania specialty crop organizations that sell products in the Main Expo Hall. According to the Pennsylvania Department of Agriculture, in 2015: •Pennsylvania Maple Syrup Producers sold more than 5,500 bags of maple cotton candy, 400 gallons of maple syrup and 90 gallons of Mapleade •The Pennsylvania State Horticulture Association sold more than 7000 apple dumplings, 65 tubs of ice cream and 200 bushels of apples •Pennsylvania Mushroom Grower’s Cooperative sold more than 7,500 pounds of mushrooms •Pennsylvania Vegetable Growers sold 11,000 servings of batter-dipped vegetables, 4,800 blooming onions, 2,500 funnel cakes, 5,600 bowls of soup, 2,000 bowls of salad, 1,700 pickles, 1,200 servings of fried pickles, 700 pieces of pie, 640 vegetable wraps, 6,400 strawberry surprises and 4,250 raspberry lemonades; •Pennsylvania Beekeepers Association sold more than 1250 gallons of honey ice cream and used more than 680 pounds of waffle mix. Our goal is to continue helping those organizations by increasing the sales of those locally grown specialty crops through improving consumer awareness of specialty crop preparation.</p> <p>The project’s importance consists in the fact that the PA Preferred Culinary Connection delivers immediate benefits to the specialty crops organizations in the form of increased sales and marketability of PA commercially-grown specialty crops; allows for increased access, availability, and consumption of PA-grown specialty crops; results in increased child and adult knowledge of the nutritional benefits of specialty crops as well as access to and consumption of specialty crops. The purpose of this project is to allow local farmers and food suppliers to showcase their specialty crops to local consumers; to educate the patrons on the health benefit to their families as well as the impact on their community’s local economy by highlighting the quality and accessibility of those products; to reach out to the restaurant community and encourage Chefs to use Pennsylvania-sourced fruits, vegetables and herbs in their establishments; and to increase the overall demand for locally grown, sustainably produced specialty crops. Our plan for the 2016 recipe book is to once again put the spot light on specialty crops, by having our Chefs make those ingredients the focal point of the dishes to be demonstrated on the PA Preferred Culinary Connection stage. Such initiative directs our audience’s attention to the variety and flavor of local fruits and vegetables and encourages them to select those products when they shop and dine. That in turn directly benefits Pennsylvania farmers and local specialty crops organizations by increasing the demand for their products. Our efforts will once again focus on fulfilling the purpose of the PA Preferred Culinary Connection – to showcase and promote the use of Pennsylvania-sourced products and particularly specialty crops in preparing original dishes, increase consumer awareness of those locally grown products and highlight the quality and accessibility of specialty crops - while incorporating entertainment, flair and celebrity talent in delivering this message. According to the PA Department of Agriculture, 93% of Pennsylvanians want to purchase locally produced items.</p> |
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|                  | <p>The 2015 PA Preferred Culinary Connection received ample media coverage, including write-ups as part of: The Patriot-News, central Pennsylvania’s award-winning top daily local news source, which, along with PennLive reaches nearly 500,000 readers weekly, the Pittsburgh Post-Gazette, Berks County Living Magazine, Fig Lancaster, Northcentral PA, The Morning Call, Times Leader, Philly.com, The Daily Item, The Town Dish, Lancaster Online, The Citizen Standard, The Express-Times, American Agriculturist, The Record Herald, Flipside PA. WHP CBS 21 and abc27 WHTM aired footage directly from the stage, conducted interviews and put the PA Preferred Culinary Connection in the spotlight, spreading the word of the importance of buying local to thousands of viewers and listeners. The Pennsylvania Cable Network (PCN), a statewide network with bureaus in Philadelphia and Pittsburgh, delivered close to six hours of live coverage directly from the PA Preferred Culinary Connection.</p> <p>Representatives from organizations such as the Pennsylvania Vegetable Growers, PA Apple Growers, PA Mushroom Institute, PA Co-Operative Potato Growers, PA Winery Association, PA Beekeepers Organization and PA Maple Syrup Producers directly participate in the stage demonstrations and hand out product samples and literature to the patrons. Their products are offered for purchase in close proximity to the PA Preferred Culinary Connection stage in the Main Expo Hall. According to the Pennsylvania Department of Agriculture: Pennsylvania Maple Syrup Producers sold more than 6,500 bags of maple cotton candy, 500 gallons of maple syrup and 250 gallons of Mapleade; The Pennsylvania State Horticulture Association sold more than 6000 apple dumplings, 7,500 quarts of apple cider, and 25 bushels of apples; Pennsylvania Mushroom Grower’s Cooperative sold more than 12,400 pounds of mushrooms; Pennsylvania Vegetable Growers sold 7,000 servings of batter-dipped vegetables, 6,000 blooming onions, 3,000 funnel cakes, 5,255 bowls of soup, 1,600 bowls of salad, 1,500 pickles, 850 pieces of pie, 700 vegetable wraps, 7,300 strawberry surprises and 2,475 raspberry lemonades; Pennsylvania Beekeepers Association sold more than 1,400 gallons of honey ice cream and used more than 700 pounds of waffle mix. Our target is to continue helping those specialty crops organizations by increasing the sales of those locally grown specialty crops through improving consumer awareness of specialty crop preparation. We anticipate those sales numbers to increase by 5% in 2017 by which directly impacting the PA Specialty Crops industry.</p> |
| Beneficiaries:   | <p>The Pennsylvania Vegetable Growers, PA Apple Growers, PA Mushroom Institute, PA Co-Operative Potato Growers, PA Winery Association, PA Beekeepers Organization and PA Maple Syrup Producers are some Commodity Groups that benefited directly from the successful execution of this project. They were able to not only showcase and sell their products to a wide range of consumers but also educate them on the benefits of using specialty crops as part of their daily menu.</p>   |
| Lessons Learned: | <p>We derive new ideas and targets at the conclusion of each successfully executed event, which we aim to implement in the years to come. In 2016, we will celebrate 100 years of Farm Show and we plan on involving as many “farm-to-table” restaurants from the area as possible and invite the Chefs to communicate their passion for using local specialty crops on their menus to our audience. We believe that we can take this grassroots movement back to local farming a</p>  |

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|                         | step further and make it all about utilizing fresh, local specialty crops. We are determined to build on our success and reach many new consumers, bring in additional partners and commodity organizations. Utilizing the social media more effectively will allow us to spread our message of the importance of specialty crops even better and to a wider demographic.   |
| Contact Person:         | Maria Hulitt<br>(267) 269-8894<br><a href="mailto:maria@strategiccontracting.com">maria@strategiccontracting.com</a>  |
| Additional Information: | For event photos, Chefs' bios and recipes, visit<br><a href="http://www.papreferred.com/culinary_connection">http://www.papreferred.com/culinary_connection</a>   |
|                         |   |
| <b>Project 7</b>        | <b>Packaged Processed Apple Product Innovation Marketing Research</b>   |
| Project Summary:        | Close to 250 of the 270 grower members of the PA Apple Marketing program grow and sell processing apples in some capacity—some of which exclusively grow processing apples. Because these apples are processed into branded products like applesauce, slices and butters, the program is limited in its avenues for promotion of processed apple products. One of the ways we can support these growers is by sponsoring consumer and marketing research to support and quantify growth for new/emerging products in the processed apple category. For this particular project we decided to focus on hard cider, due to its growing popularity and potential market growth. Hard cider presents opportunities for growers looking expand their value-added offerings by getting into hard cider production, but also creates new markets for apple growers with processing varieties that have been steadily decreasing in value—there is currently more demand than there is supply for some cider and heirloom varieties. Sponsoring this research for the benefit of the entire Pennsylvania apple industry shows the program's commitment to processing growers and does the work of validating new potential markets for growers and processors. Additionally, the educational workshops that were also part of this project provided growers and producers with critical information needed to navigate a complicated licensing system and get started with their own hard cider business. |
| Project Approach:       | <p>Penn State extension was selected as our research partner for this project. They conducted several market research and producer education events under as part of this grant project, including:</p> <p><b>12/4/14 – Hard Cider Producer Bus Tour – Virginia Cideries (depart: Gettysburg, PA)</b></p> <div> </div> <p>This educational one day tour enabled industry professionals, including hard cider producers, fruit growers, cider press business owners and support industry personnel to experience first-hand, behind the scenes tours with 5 accomplished Virginia cider operations. This event allowed producers the important opportunity to network and be introduced to others in this emerging industry to share cider apple specific production and sales processes, start up information and cidery operations management information for the betterment of the growing industry segment.</p>   |

*Promotional Flyer for Hard Cider Tour*

**7/25/15 – Business of Hard Cider Workshop, Altoona, PA**

This workshop brought together producer and legal experts to offer participants a unique educational experience regarding the business, production and marketing aspects of running a hard cider business in Pennsylvania.

**Workshop Sessions**

Marketing Trends – Carla Snyder, Penn State Extension

State and Federal Regulations – Jeffrey Lawrence, Pennsylvania Liquor Control Board & Fran O’Brian, Attorney at Law

Pennsylvania Alcohol Marketing – Jennifer Eckinger, PA Wine Association, Greg O’Loughlin, SWELL Marketing, and Samantha Snyder, PA Preferred

Small Farm Cidery Production – Eric Shatt, Cornell University and Red Byrd Orchard Cidery

Distribution Dilemma: Best Practices for Farm Cideries – Hank Frecon, Frecon Farms and Cidery

**12/1/14 – 9/30/15 – Hard Cider Guidebook: A Producers Guide to Developing a Hard Cider Business in Pennsylvania**

This guide was designed to walk new cider makers through every step required to register their business with local, state and federal regulatory agencies so they are able to open their doors faster. Many new cideries around the state have struggled with business registration and licensing because hard cider is still a regulatory gray area in Pennsylvania, with many specific questions requiring a direct legal opinion from the licensing agent before the business is able to move forward. With this guide, we hope to demystify the steps. It provides straightforward links and a timeline for all form submissions and direct contact information for cider maker frequently asked questions. It is our hope that this guide will aid in the growth of Pennsylvania's hard cider industry, providing renewed opportunities for process and fresh market apple growers.

*Press release distributed regarding the publishing of the Hard Cider Guidebook.*



For Immediate Release  
Contact:  
Carla Snyder  
Penn State Extension  
[Snyder.carla@psu.edu](mailto:Snyder.carla@psu.edu)  
717-334-6271

#### Pennsylvania's first Hard Cider Guidebook Released

Penn State Extension is happy to announce the release of the Hard Cider Guidebook: A Producers Guide to Developing a Hard Cider Business in Pennsylvania. Made possible by the generous support provided by the PA Apple Marketing Program, the State Horticultural Association of Pennsylvania and the USDA Specialty Crop Block Grant program we are happy to provide a resources that directly addresses the business development and marketing needs of the growing cider industry in Pennsylvania.

Currently hard cider sales in cities throughout Pennsylvania rank 3<sup>rd</sup>, 6<sup>th</sup> and 7<sup>th</sup> as the highest selling cider markers in the nation when compared to percent of beer market sales. "This burgeoning market, who saw sales skyrocket 71% in 2014, is continuing a steady and sustainable growth trend for 2015 and 2016," said Carla Snyder, Penn State Extension Hard Cider Educator. Compared with other food categories, cider is still soaring. With market trends following the craft beer market as well as the UK cider market, the U.S. cider industry is well poised to become a big player in the beverage arena and this means nurseries, apple growers and custom cider presses will continue to have an opportunity to participate in the hard cider market.

This guide is designed to walk new cider makers through every step required to register their business with local, state and federal regulatory agencies so they are able to open their doors faster. Many new cideries around the state have struggled with business registration and licensing because hard cider is still a regulatory gray area in Pennsylvania with many specific questions requiring a direct legal opinion from the licensing agent before the business is able to move forward. With this guide, we hope to demystify the steps. It provides straightforward links and a timeline for all form submissions and direct contact information for cider maker frequently asked questions. It is our hope that his guide will aid in the growth of Pennsylvania's hard cider industry, providing renewed opportunities for process and fresh market apple growers.

An interactive, digital copy of the guide can be found at Penn State Extension's Hard Cider webpage  
<http://extension.psu.edu/business/farm/hard-cider>

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#### **10/1/15 – 1/31/16 – Hard Cider Producer and Consumer Independent Research**

Hard cider production is increasingly becoming an economically attractive value-added product in the apple industry. Engaging in this new industry, in our highly regulated food production environment, requires extensive education on business planning and set-up as well



as on the frequent regulatory changes within the industry. In addition, to be viable in the market place producers must keep up to date on market trends as consumers adapt to and engage with this new industry. To enable the industry to thrive, continued research and education is a necessity.

**10/1/15 – 1/31/16 – CiderCulture: Agricultural Literacy Program -Consumer Education & Marketing**



CiderCulture is a partnership collaboration with Town Dish LLC for the purposes of creating and maintaining an online cider education magazine and associated social media outlets aimed at providing up to date trends and marketing information for producers and consumers on the East Coast.

*Screen shot of CiderCulture.com*

**2/1/16 – Seed to Sip Hard Cider Workshop, Middletown, PA**

This educational workshop was offered as a pre-conference session in conjunction with the Mid-Atlantic Fruit and Vegetable Convention. Topics included sensory analysis, cider apple



production and management, a presentation of 2016 consumer trends as well as cider fermentation science.

*(Left: Photo from Seed to Sip workshop.)*

**Workshop Sessions**

Hard Cider Marketing Trends – Carla Snyder, Penn State Extension

Developing the Modern American Hard Cider Orchard – Eric Shatt, Cornell University

Benchmark Tasting of Fruit Ciders – Denise Gardner, Penn State Extension

Content Marketing – Mary Bigham, Town Dish LLC

Hard Cider Production: A Closer Look at Fermentation – Denise Gardner, Penn State Extension



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|                                     | <p><b>3/18/16 – Seed to Sip Hard Cider Producers Tour, Hudson Valley, NY (from: Allentown, PA)</b><br/> This educational one day tour enabled industry professionals including hard cider producers, fruit growers, cider press business owners and support industry personnel to experience first-hand, behind the scenes tours with 4 accomplished New York cider operations. This event allowed producers the important opportunity to network with, and be introduced to, others in this emerging industry to share cider apple specific production and sales processes, start up information and cidery operations management information for the betterment of the growing industry segment. This event also included a rolling classroom component where University experts presented educational sessions during transit directly related to tour stops.</p> <p><b><u>Tour Stops</u></b><br/> Applewood Winery, Warwick NY<br/> Warwick Valley Winery, Pine Island, NY<br/> Angry Orchard, Walden, NY<br/> Kettleborough Cider House, New Paltz, NY</p> <p><b>3/19/16 – Seed to Sip Hard Cider Workshop, Center Valley, PA</b><br/> This educational workshop, which built upon learning objectives attained from the Hard Cider Bus Tour the previous day, focused on marketing, cider apple production, sensory analysis of final product, and teaching scientific skills such as titration to a cider maker audience.</p> <p><b><u>Workshop Sessions</u></b><br/> The Quest for Apple Tannins – Edwin Winzler, Penn State Fruit Research and Extension Center<br/> Hard Cider Marketing Trends – Carla Snyder, Penn State Extension<br/> Sensory Analysis and Blending Demonstration – Edwin Winzler, Penn State Fruit Research and Extension Center<br/> Content Marketing – Mary Bigham, Town Dish LLC<br/> Craft Cider Making: From Press to Sip–Scott Topel, Cider Master, Wyndridge Farm<br/> Titration Demonstration – Scott Topel, Cider Master, Wyndridge Farm<br/> Introduction to Hard Cider Guidebook: A Producers Guide to starting a Cider Business in PA – Carla Snyder, Penn State Extension</p> |
| <p>Goals and Outcomes Achieved:</p> | <p><b>12/4/14 – Hard Cider Producer Bus Tour – Virginia Cideries (depart: Gettysburg, PA)</b></p> <p><b><u>Event/Survey Response Data</u></b></p> <ul style="list-style-type: none"> <li>• <b>43 total</b> attendees representing <b>12 Pennsylvania counties</b></li> <li>• 92% of respondents indicated this training met their learning objectives</li> <li>• 50% of respondents indicated they anticipate increased business profitability as a result of knowledge gained at this training.</li> <li>• 58% of respondents indicated they anticipate increased business productivity as a result of knowledge gained at this training.</li> <li>• 25% of respondents indicated they anticipate that they will be able to hire at least one new employee as a result of knowledge gained at this training</li> <li>• 16% of respondents indicated they anticipate the ability to recognize cost savings as a</li> </ul>   |

result of knowledge gained at this training

- 50% of respondents indicated they anticipate increased efficiency as a result of knowledge gained at this training.

### Penn State Extension Expanded Allowable Revisions to Approved Alcoholic Beverage Labels

On September 29, 2014, an amendment was passed with the Alcohol Tobacco Tax and Trade Bureau to expand allowable revisions to your already approved hard cider labels. This will allow you to make quick, reasonable changes to your labels without applying for a new Certificate of Label Approval or COLA.

Under the new expansion you're able to make very specifically outlined changes to:

- Your promotional graphics
- A claim of a rating, award or recognition
- Organic labels
- Your sulfite statement
- Batch numbers
- Instruction on how to consume or serve your beverage

Here is the breakdown of what you are allowed to change in each of these categories:

#### Promotional Graphics

In the graphics category you're able to delete or change sponsorship graphics including logos, artwork, dates, event location or other information related to a specific sponsorship. However, just be sure to check with your sponsor first to be sure any revisions are allowed by your partnering third party. It's always good to keep records of label or graphic changes on file in case you need to refer to them in the future.



Here's a quick example of an event label for a corporate client. This would be an allowable change under this rule.

#### Claim of a Rating, Award or Recognition

This amendment also allows you to change, add or delete a label or sticker that provides information about a rating or recognition you may have received. Just be sure to not make any specific substantive claims about the product or your competitors. It's always best to be fair to the competition.



#### Organic Labels

Additionally you have the option to delete all organic references from your label. However, if you delete one claim you must delete them all. The deletion of individual references or certifications of organic claims is not permitted without a new COLA.



tour participants

#### Sulfite Statement -

To change your sulfite statement the rule provides choices. You can choose from any of the options listed below but make sure they are exact!

- "Contains Sulfites"
- "Contains (a) Sulfiting Agent(s)"
- "Contains Naturally Occurring and Added Sulfites"
- "Contains (name of specific sulfiting agent)"
- "Contains Naturally Occurring Sulfites"
- "Sulfites" may be used in lieu of "Sulfites"

#### Batch Numbers

You are also able to change your information regarding batch numbers. This allows for the addition, deletion or alteration of information about the number of bottles you have produced per batch.

#### Instructions on how to consume or serve your beverage -

Lastly, you are able to choose from a list of approved statements including consumers on how to serve your product.

- "Refrigerate After Opening"
- "Do Not Store in Direct Sunlight"
- "Best if Frozen for to Hours"
- "Shake Well"
- "Pour Over Ice"
- "Best When Chilled"
- "Best Served Chilled"
- "Serve Chilled"
- "Serve at Room Temperature"

Just remember the seven topics covered here are an expanded allowable list of changes to your label that do not require you to reapply for your Certification of Label Approval. Happy cider making!



Example of Sulfite Statement  
Example of Batch Number



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Ag Entrepreneurship/Marketing  
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Penn State Extension  
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Information  
distributed to  
regarding  
labeling  
provisions.

## Workshop, Altoona, PA

### Event Data

- 74 attendees representing 6 states.
- 33 attendees from Pennsylvania representing 45% of the audience.
- 100% of respondents indicated this event met their learning objectives
- 75% of respondents indicated they anticipate increased business profitability as a result of knowledge gained at this training.
- 63% of respondents indicated they anticipate increased business productivity as a result of knowledge gained at this training.
- 33% of respondents indicated they anticipate that they will be able to hire at least one new employee as a result of knowledge gained at this training
- 33% of respondents indicated they anticipate the ability to recognize cost savings as a result of knowledge gained at this training
- 50% of respondents indicated they anticipate increased efficiency as a result of knowledge gained at this training.

## 2/1/14 – 9/30/15 – Hard Cider Guidebook: A Producers Guide to Developing a Hard Cider Business in Pennsylvania

The Penn State Extension team used grant funds for the development, research, design and publication of the Hard Cider Guidebook. The Guidebook serves as the go-to guide for producers interested in starting a hard cider business in Pennsylvania. The content of the

guide was reviewed and approved by both State and Federal regulatory organizations. An electronic version of the guide will be maintained and updated as needed and is housed on Penn State Extension’s website. The Hard Cider section of PennsylvaniaApples.org also has a link to the guide. A press release was distributed to media to announce the availability of the guidebook. Production of the guidebook and its availability has been shared with trade publications and through presentations at grower meetings.

The published guide is available in print and online and can be accessed at:  
<http://extension.psu.edu/business/farm/hard-cider/hard-cider-guidebook/view>

**10/1/15 – 1/31/16 – Hard Cider Producer and Consumer Independent Research**  
*Research findings follow.*

## Penn State **Extension**

### Hard Cider Consumer and Producer Trends

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#### Abstract

Hard cider production is increasingly becoming an economically attractive value-added product in the apple industry. Engaging in this new industry, in our highly regulated food production environment, requires extensive education on business planning and set-up as well as on the frequent regulatory changes within the industry. In addition, to be viable in the market place producers must keep up to date on market trends as consumers adapt to and engage with this new industry. To enable the industry to thrive, continued research and education is a necessity.

Little research exists on the hard cider industry that focuses on the U.S. Mid-Atlantic region. Hard Cider production in the East Coast region of the U.S. only recently became a growth industry. Currently only one study examines consumption trends of hard cider therefore further in depth surveying is needed to determine trends base on taste, purchasing methods, and to catalogue new innovations in the industry.

In order to keep up with growing market trends hard cider producers must continually monitor the market for preferences and trends to capitalize on and engage with customers in this evolving industry.

#### Hard Cider Consumer Trends

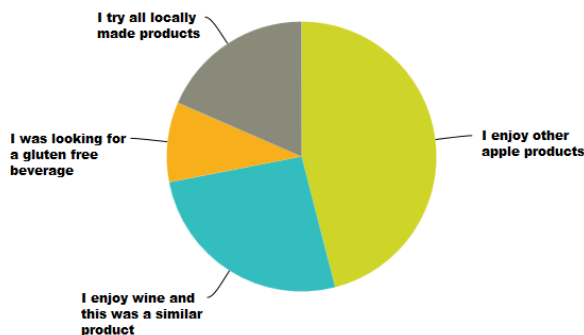
##### Procedures

Hard Cider consumer research was gathered via in-person interactive dot surveys at cider festivals from New York to North Carolina from October 2015 to December 2015. All 986 participants were self-identified as adult hard cider consumers.

##### Results and Discussion

#### What made you try hard cider the first time?

Answered: 574 Skipped: 412



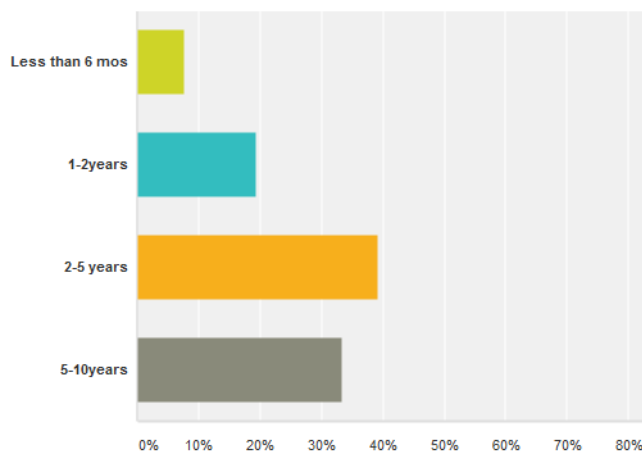
This consumer trends research sheds light on consumer preferences and trends in relation to products produced within the hard cider industry as well as how to best engage with consumers.

When looking to bring new customers to the market place, 46% of consumers surveyed indicated that they tried hard cider for the first time because they enjoy other apple products, while only 26% indicated it was due to their enjoyment of wine and their relation of

hard cider as a similar product. This indication, combined with the 18% of consumers who said they tried hard cider for the first time because they prefer to try locally made products, clues hard cider producers into why consumers are entering the hard cider market. Combined, these two groups of consumer interested in hard cider because of its relation to local or apple products shows a preference and niche market that producers can capitalize on. When comparing this data to that which drives larger commercial cider producers such as those producing the Angry Orchard brand, we can see a similarity translated in their marketing approach. By highlighting the orchard and farming practices of the production of their product, Angry Orchard is looking to capitalize on a consumer preference for locally made and apple based products.

### How long have you been drinking hard cider?

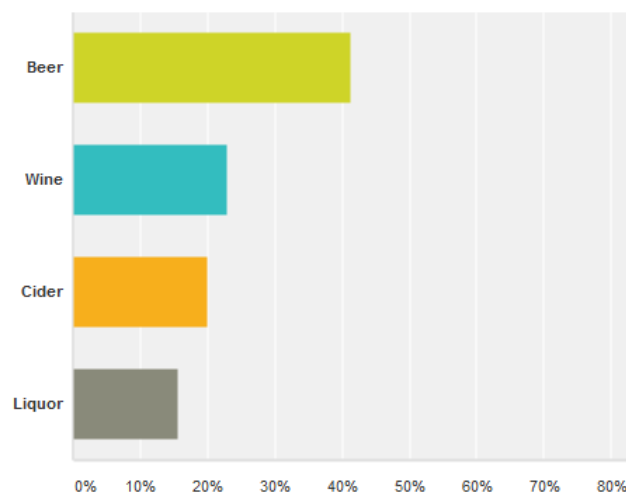
Answered: 550 Skipped: 436



Additionally our surveys found that the majority of cider consumer respondents have been drinking cider for 2 to 5 years (39%), most often drink beer when selecting an alcoholic beverage (41%), and consume hard cider year round (80%) as opposed to those who only enjoy it seasonally (20%). This indicates potential for a year round market that is growing in sophistication and knowledge about the beverage and follows the trend that began in the craft beer industry several years ago. If 41% of hard cider consumers are most often consumers of beer it provides indication that they may be looking for the same type of characteristics that set the craft beer market apart such as quality ingredients, targeted marketing, local hand crafted production techniques and the ability to lessen the gap between producer and consumer just as in the local food movement.

### What type alcoholic beverage do you drink most often?

Answered: 660 Skipped: 326



Concerning distribution and marketing to the cider consumer base our survey indicates that the majority of consumers are purchasing cider at bars and restaurants (37%)

and beer distributors (29%). However, 16% of consumers purchase at tasting rooms and of the 986 cider consumers surveyed 40% indicated they would be willing to travel between 30 and 60 minutes to visit a new tasting room, with 30% saying they would travel over 1 hour. To reach these customers, 48% indicated they find information about the hard cider industry at festivals and 28% indicated social media was their main method of gaining hard cider information.

When determining cider styles, surveyed consumers preferred semi-sweet (37%), dry (28%), or sweet (26%).

#### **Hard Cider Producer Trends**

##### **Procedure**

Commercial hard cider business owners, head cider maker employees of hard cider businesses and producers in the process of opening a hard cider business from Pennsylvania, North Carolina, Delaware, and Virginia responded to an online survey regarding their business and marketing practices. 20 total respondents participated in the survey in December 2015.

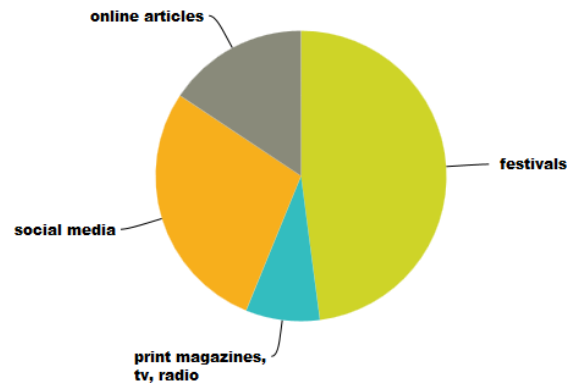
##### **Results and Discussion**

The majority of respondents have been operating a hard cider business for less than 2 years (80%). Of the ciders responding, most cider makers are referring to other hard cider producers, online and print news articles and wine industry trends several times a month when looking for hard cider industry ideas.

Producers are marketing to 30 to 45 year old consumers with an annual household income of \$61,000 to \$81,000. Their primary method of conveying information about their product to their customer is via word of mouth (94%), social media (89%) and at festivals and tasting rooms (72%). The majority of cider makers are selling their cider at tasting rooms or at bars and restaurants with 63% of respondents indicating they have their own tasting room.

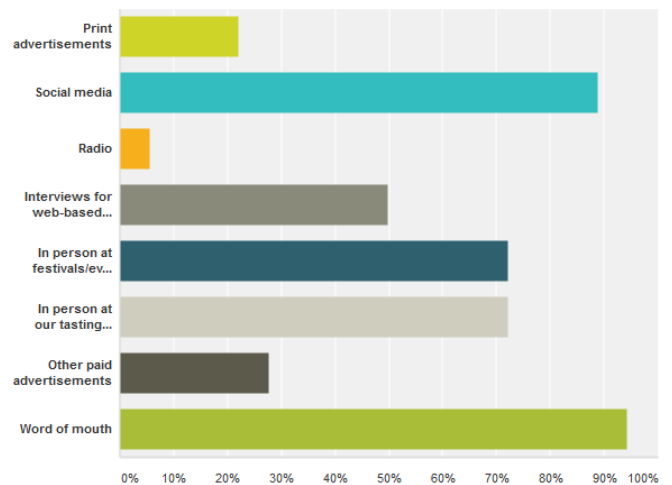
#### **How do you find information about the hard cider industry?**

Answered: 607 Skipped: 379



#### **How do you communicate information about your hard cider product to consumers? (check all that apply)**

Answered: 18 Skipped: 2



Producer Hard Cider Research Q4 2015

52% of respondents are marketing directly to wine or beer drinkers specifically, with 72% marketing to beer drinkers and 90% marketing to wine drinkers. Those targeting beer drinkers are primarily including hopped cider in their varieties or vending at beer festivals while those targeting wine drinkers are offering tastings at wineries and wine festivals as well as providing higher quality packaging and single variety ciders.

When asked what cider producers perceived their customers were looking for respondents indicated crisp flavor, high quality and “something different” to be the outstanding markers. In response to these perceptions, when asked about innovative practices, cider makers responded by stating that they were making drier ciders and utilizing filtration techniques that result in a crisp, clean flavor.

### **Conclusion**

This research represents a snapshot of the evolving hard cider market from both the consumer and producer perspectives. By taking a cue from consumer preferences in both product qualities and communication methods producers are able to amend their approach so their best product can continue to be recognized and discovered by new and continuing cider consumers. The method, by which consumers are seeking out information about hard cider, including where to purchase cider, is of particular importance as many producers are missing the mark by communicating using different methods or tools. While a variety of communication and marketing methods is always best practice, survey results indicate the majority (48%) of consumers are gaining knowledge about hard cider via festivals and only 28% via social media. While creating marketing information keep in mind the strong trend in cider to follow the craft beer industry with 41% of cider consumers most frequently choosing beer when drinking an alcoholic beverage. This trend also holds true to consumer preference for a local, apple based product following the craft beer trend which places emphasis on ingredient quality and a tie to the agricultural roots of the product.

### **Acknowledgements**

Thank you to the Research Committee of the State Horticultural Association of Pennsylvania, the Pennsylvania Apple Marketing Program, and the USDA Specialty Crop Block Grant Program for funding this study.

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Where trade names appear, no discrimination is intended, and no endorsement by Penn State Extension is implied.

**2/1/16 – Seed to Sip Hard Cider Workshop, Middletown, PA**



## Event Data

- **92 attendees** representing 6 states.
- **35 attendees** from Pennsylvania representing 57% of the audience.
- **100%** of respondents indicated this event met their learning objectives
- **67%** of respondents indicated they anticipate increased business profitability as a result of knowledge gained at this training.
- **51%** of respondents indicated they anticipate increased business productivity as a result of knowledge gained at this training.
- **13%** of respondents indicated they anticipate that they will be able to hire at least one new employee as a result of knowledge gained at this training
- **25%** of respondents indicated they anticipate the ability to recognize cost savings as a result of knowledge gained at this training
- **52%** of respondents indicated they anticipate increased efficiency as a result of knowledge gained at this training.

HC Program Series - Seed to Sip 2/1/16

Appendix IVA

As a direct result of this training I will . . .

| Answer Options    | Response Count |
|-------------------|----------------|
|                   | 52             |
| answered question | 52             |
| skipped question  | 13             |

| Number | Response Date       | Response Text   | Categories |
|--------|---------------------|---|------------|
| 1      | Feb 8, 2016 6:59 PM | Continue to learn more while working at cidery  |            |
| 2      | Feb 8, 2016 6:58 PM | Study it more   |            |
| 3      | Feb 8, 2016 6:57 PM | Apply fermentation techniques to my products  |            |
| 4      | Feb 8, 2016 6:56 PM | Build a better plan to start a cidery   |            |
| 5      | Feb 8, 2016 6:51 PM | Have more solid foundation to better serve our customers  |            |
| 6      | Feb 8, 2016 6:50 PM | Understand the needs and requests of potential customers (cideries)   |            |
| 7      | Feb 8, 2016 6:48 PM | Pay better attention to fermentation chemistry  |            |
| 8      | Feb 8, 2016 6:47 PM | Look into cider more  |            |
| 9      | Feb 8, 2016 6:44 PM | Continue/improve cider production   |            |
| 10     | Feb 8, 2016 6:43 PM | Plan to start making hard cider   |            |
| 11     | Feb 8, 2016 6:33 PM | Better idea of you cidery's needs   |            |
| 12     | Feb 8, 2016 6:30 PM | be more aware of the decisions and hurdles necessary to starting/running a hard cider business  |            |
| 13     | Feb 8, 2016 6:28 PM | blog more   |            |
| 14     | Feb 8, 2016 6:27 PM | Continue to refer to Penn St for more information   |            |
| 15     | Feb 8, 2016 6:22 PM | Grow cider apples but not start a cidery!   |            |
| 16     | Feb 8, 2016 6:20 PM | Be trying to make hard cider  |            |
| 17     | Feb 8, 2016 6:19 PM | Be able to use more effective marketing strategies  |            |
| 18     | Feb 8, 2016 6:17 PM | Know more industry players  |            |
| 19     | Feb 8, 2016 6:16 PM | have a more successful cider orchard  |            |
| 20     | Feb 8, 2016 6:15 PM | Keep educating myself in the technical lab use for making my ciders   |            |
| 21     | Feb 8, 2016 6:13 PM | Start working towards my own brewery  |            |
| 22     | Feb 8, 2016 6:12 PM | Possibly discontinue MLF  |            |
| 23     | Feb 8, 2016 6:10 PM | Learn more! I've been given lots of places I need to deepen my learning on my way to continuing to develop my orchard and embark on the journey of starting a cidery. |            |
| 24     | Feb 8, 2016 6:08 PM | Continue speaking to more people  |            |
| 25     | Feb 8, 2016 6:06 PM | Continue to experiment and dream  |            |
| 26     | Feb 8, 2016 6:04 PM | Make more cider, read suggested literature, purchase supporting equipment   |            |
| 27     | Feb 8, 2016 5:59 PM | Probably not go into commercial production anytime soon.  |            |
| 28     | Feb 8, 2016 5:41 PM | Initiate a cider business successfully  |            |
| 29     | Feb 8, 2016 5:39 PM | Better understand the H.C. process  |            |
| 30     | Feb 8, 2016 5:38 PM | Continue learning and planning  |            |
| 31     | Feb 8, 2016 5:37 PM | Make better cider? Make more cider  |            |
| 32     | Feb 8, 2016 5:34 PM | Am advancing my plans for establishing a business in either PA or MD.   |            |
| 33     | Feb 8, 2016 5:29 PM | Better understand the concept of producing hard cider   |            |
| 34     | Feb 8, 2016 5:25 PM | Refine my cider production techniques   |            |
| 35     | Feb 8, 2016 5:23 PM | Make cider tree sales   |            |
| 36     | Feb 8, 2016 5:21 PM | Look at measuring yan. Research stabilizing sweet. Check my yeast more thoroughly.  |            |
| 37     | Feb 8, 2016 5:19 PM | Try and get into the business   |            |
| 38     | Feb 8, 2016 5:18 PM | Further pursue my cider fascination, make some, and who knows   |            |
| 39     | Feb 8, 2016 5:15 PM | Apply knowledge related to fruit growing  |            |
| 40     | Feb 8, 2016 5:13 PM | Continue to learn   |            |
| 41     | Feb 8, 2016 5:11 PM | Begin brewing some cider  |            |
| 42     | Feb 8, 2016 5:09 PM | Look into making hard cider   |            |
| 43     | Feb 8, 2016 2:07 PM | MOVE FORWARD WITH EXPERIMENTING WITH HARD CIDER IN OUR OPERATION  |            |
| 44     | Feb 8, 2016 2:04 PM | REWORK FERMENTATION EXPERIMENT WITH DIFFERENT YEASTS  |            |
| 45     | Feb 8, 2016 2:00 PM | BEGIN THE PROCESS OF DEVELOPING A CIDER PRODUCTION OPERATION  |            |
| 46     | Feb 8, 2016 1:58 PM | WE ARE WORKING TO CREATE A MEADERY FOR MEAD PRODUCTION  |            |
| 47     | Feb 8, 2016 1:56 PM | INCORPORATE KNOWLEDGE INTO MY WINE AND HARD CIDER MAKING  |            |
| 48     | Feb 3, 2016 9:14 PM | Do more research on growing cider apples. Do another tasting within a different category  |            |
| 49     | Feb 3, 2016 8:53 PM | Apply to my winery  |            |
| 50     | Feb 3, 2016 7:24 PM | Investigate/invest in measuring equipment (filtration) Investigate/invest in planting cider specific apples in our orchards Taste more cider for research.            |            |
| 51     | Feb 3, 2016 7:20 PM | be able to produce a better product and to market effectively.  |            |
| 52     | Feb 3, 2016 7:14 PM | Do better with content marketing  |            |

## Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

HC Program Series - Seed to Sip 2/1/16

Appendix IVB

Please list particular skills or knowledge gained at this training that will help you in your enterprise

| Answer Options    | Response Count |
|-------------------|----------------|
|                   | 51             |
| answered question | 51             |
| skipped question  | 14             |

| Number | Response Date       | Response Text   | Categories |
|--------|---------------------|---|------------|
| 1      | Feb 8, 2016 6:59 PM | Fermentation - Chemistry to flavor profile  |            |
| 2      | Feb 8, 2016 6:58 PM | Fermentation - taste evaluation   |            |
| 3      | Feb 8, 2016 6:57 PM | Proper form - Proper trees to plant and differences   |            |
| 4      | Feb 8, 2016 6:56 PM | -orchard considerations -process overview for planning -thermal control   |            |
| 5      | Feb 8, 2016 6:54 PM | Marketing - contacts - education on process - cider tasting   |            |
| 6      | Feb 8, 2016 6:53 PM | Fermentation styles and fining/sugar add before bottling  |            |
| 7      | Feb 8, 2016 6:51 PM | In depth sensory attributes - Nitrogen content - Gained insight re: "YAN"   |            |
| 8      | Feb 8, 2016 6:50 PM | apple types - YAN information   |            |
| 9      | Feb 8, 2016 6:48 PM | Fermentation chemistry  |            |
| 10     | Feb 8, 2016 6:47 PM | Fermentation talk was great   |            |
| 11     | Feb 8, 2016 6:43 PM | -fermentation -growing apples for hard cider  |            |
| 12     | Feb 8, 2016 6:32 PM | Where do we get started   |            |
| 13     | Feb 8, 2016 6:30 PM | Layout of Eric's cider facility. The confidence that a few acres and around 4-5K gallons would be a profitable business, necessary marketing aspects.                                 |            |
| 14     | Feb 8, 2016 6:27 PM | Better understanding of rootstock = varieties - New marketing goals and strategies  |            |
| 15     | Feb 8, 2016 6:22 PM | Apple selection   |            |
| 16     | Feb 8, 2016 6:20 PM | I knew very little about cider. Workshop was very informative.  |            |
| 17     | Feb 8, 2016 6:19 PM | Marketing, sulfuric smell control techniques  |            |
| 18     | Feb 8, 2016 6:17 PM | Cider orchard planning  |            |
| 19     | Feb 8, 2016 6:15 PM | Heightened-media marketing usage -science of it   |            |
| 20     | Feb 8, 2016 6:13 PM | Fermentation, yeasts  |            |
| 21     | Feb 8, 2016 6:12 PM | Nitrogen awareness  |            |
| 22     | Feb 8, 2016 6:10 PM | Chemistry! Marketing using content -seeing what a small scale cidery actually looks like (Eric)   |            |
| 23     | Feb 8, 2016 6:08 PM | Content marketing - to date stats and survey results=very helpful   |            |
| 24     | Feb 8, 2016 6:06 PM | Apple varieties, cultural techniques, real experience from producer.  |            |
| 25     | Feb 8, 2016 6:04 PM | Yeast knowledge/primary fermentation - desirable chemistry for juice - Small-scale brewery set-up   |            |
| 26     | Feb 8, 2016 5:59 PM | I learned about books and other research sites that I need to pursue to get more knowledge  |            |
| 27     | Feb 8, 2016 5:47 PM | Choosing varieties of apples and fermentation   |            |
| 28     | Feb 8, 2016 5:41 PM | Yeast selection   |            |
| 29     | Feb 8, 2016 5:38 PM | Chemistry of cider production   |            |
| 30     | Feb 8, 2016 5:37 PM | Good fermentation nutrients. Practical production processes.  |            |
| 31     | Feb 8, 2016 5:34 PM | -fermentation and yeast, mechanics -apple varieties   |            |
| 32     | Feb 8, 2016 5:29 PM | Cider appears to be on the way up. I may have a niche in Blueberry country. Tasting- what to look for (I need work on that) - Marketing tips - Yeast and processes cider goes through |            |
| 33     | Feb 8, 2016 5:25 PM | Fermentation/chemistry - Marketing trends   |            |
| 34     | Feb 8, 2016 5:23 PM | Better understanding the varieties and their growing habits as I make cider variety orchard recommendations.  |            |
| 35     | Feb 8, 2016 5:19 PM | Too many things to list   |            |
| 36     | Feb 8, 2016 5:18 PM | New found knowledge on fermentation - New insights into orchards  |            |
| 37     | Feb 8, 2016 5:15 PM | N/A   |            |
| 38     | Feb 8, 2016 5:13 PM | Chemistry - Yeast selection   |            |
| 39     | Feb 8, 2016 5:11 PM | Good general knowledge about cider brewing process  |            |
| 40     | Feb 8, 2016 2:07 PM | -INFORMATION ON FERMENTATION -APPLICATION OF CURRENT ORCHARD DESIGN TO HARD CIDER VARIETIES   |            |
| 41     | Feb 8, 2016 2:04 PM | FERMENTATION, TASTING EXPERTISE   |            |
| 42     | Feb 8, 2016 2:00 PM | THE PRODUCTION FLOW DIAGRAM AS WELL AS SPECIFIC INFORMATION ABOUT CONTROLLING PRIMARY FERMENTATION  |            |
| 43     | Feb 8, 2016 1:58 PM | MARKETING INFO  |            |
| 44     | Feb 8, 2016 1:56 PM | FERMENTATION AND YEAST TYPES  |            |
| 45     | Feb 3, 2016 8:53 PM | Marketing, trends to help grow industry   |            |
| 46     | Feb 3, 2016 7:26 PM | Apple varieties/growing - Yeast - choices/management  |            |
| 47     | Feb 3, 2016 7:24 PM | -Cider specific apples/soil mass styles -content marketing  |            |
| 48     | Feb 3, 2016 7:20 PM | Specific fermentation details - Using content marketing   |            |
| 49     | Feb 3, 2016 7:16 PM | I had no prior knowledge in hard cider/wine production. I need to start at beginning.   |            |
| 50     | Feb 3, 2016 7:15 PM | Knowledge of cider varieties - growing cider varieties  |            |
| 51     | Feb 3, 2016 7:14 PM | tasting knowledge helpful   |            |

### 3/18/16 – Seed to Sip Hard Cider Producers Tour, Hudson Valley, NY (from: Allentown, PA) Event Data

- 49 attendees representing 10 states.
- 31 attendees from Pennsylvania representing 63% of the audience.
- 97% of respondents indicated this event met their learning objectives
- 90% of respondents indicated they anticipate increased business profitability as a result of knowledge gained at this training.
- 80% of respondents indicated they anticipate increased business productivity as a result of knowledge gained at this training.
- 48% of respondents indicated they anticipate that they will be able to hire at least one new employee as a result of knowledge gained at this training
- 41% of respondents indicated they anticipate the ability to recognize cost savings as a result of knowledge gained at this training
- 71% of respondents indicated they anticipate increased efficiency as a result of knowledge gained at this training.

## Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

### 3/18/16 Hard Cider Tour - Hudson Valley, NY

As a direct result of this training I will...

| Answer Options    | Response Count |
|-------------------|----------------|
|                   | 33             |
| answered question | 33             |
| skipped question  | 3              |

| Number | Response Date       | Response Text   | Categories |
|--------|---------------------|---|------------|
| 1      | Apr 1, 2016 8:10 PM | be using a different orchard style than originally planned  |            |
| 2      | Apr 1, 2016 8:07 PM | consider different packaging for ciders   |            |
| 3      | Apr 1, 2016 8:06 PM | have a more thorough base of knowledge for business planning  |            |
| 4      | Apr 1, 2016 8:03 PM | can and use smaller bottles   |            |
| 5      | Apr 1, 2016 8:02 PM | be much more knowledgeable and more prepared for this business  |            |
| 6      | Apr 1, 2016 7:53 PM | work on plan for installing press facility  |            |
| 7      | Apr 1, 2016 7:40 PM | start working on my business plan and applying for my license.  |            |
| 8      | Apr 1, 2016 7:38 PM | switch fermenting vessels for my cidery in planning to flex tanks   |            |
| 9      | Apr 1, 2016 7:32 PM | expand our cider making program   |            |
| 10     | Apr 1, 2016 7:16 PM | be better equipped to setup my cidery, plant trees this Spring on a trellis system and continue relationships with others in the industry |            |
| 11     | Apr 1, 2016 7:13 PM | design my tasting room and production facility from examples live seen today  |            |
| 12     | Apr 1, 2016 7:10 PM | continue to experiment  |            |
| 13     | Apr 1, 2016 7:07 PM | Apply knowledge to our tasting room design  |            |
| 14     | Apr 1, 2016 6:51 PM | invest in tanks and make the leap try to press apples when they are warm  |            |
| 15     | Apr 1, 2016 6:39 PM | make new ciders (diversity) change packaging type   |            |
| 16     | Apr 1, 2016 6:36 PM | do very well tomorrow, and reconsider my tannin assumptions   |            |
| 17     | Apr 1, 2016 6:34 PM | be better prepared to startup   |            |
| 18     | Apr 1, 2016 6:28 PM | have a better concept of the state of Hudson Valley ciders and the needs/concerns of growing and cidemakers                               |            |
| 19     | Apr 1, 2016 6:15 PM | source more diverse varieties of apples   |            |
| 20     | Apr 1, 2016 6:13 PM | keep making cider   |            |
| 21     | Apr 1, 2016 6:10 PM | continue my open disdain for Angry Orchard but apple knowledge I gained in my work  |            |
| 22     | Apr 1, 2016 6:08 PM | research more about hard cider  |            |
| 23     | Apr 1, 2016 6:07 PM | have better knowledge of cider blends   |            |
| 24     | Apr 1, 2016 6:05 PM | expand our cider production   |            |
| 25     | Apr 1, 2016 5:58 PM | drink more cider  |            |
| 26     | Apr 1, 2016 5:56 PM | connect with orchards about growing specific apple varieties, possible grow your own apples   |            |
| 27     | Apr 1, 2016 5:41 PM | continue to seek training   |            |
| 28     | Apr 1, 2016 5:37 PM | pursue a MS degree in fermentation studies  |            |
| 29     | Apr 1, 2016 5:32 PM | make more cider   |            |
| 30     | Apr 1, 2016 5:28 PM | Talk to my local municipality, rent a production facility, file for a TTB Permit/PLCB and hopefully open my cidery!                       |            |
| 31     | Apr 1, 2016 5:21 PM | energized to move forward   |            |
| 32     | Apr 1, 2016 5:18 PM | Have a better understanding of cider production   |            |
| 33     | Apr 1, 2016 5:15 PM | proceed to plant an orchard   |            |

### 3/18/16 Hard Cider Tour - Hudson Valley, NY

Please list particular skills or knowledge gained at this training that will help you in your enterprise.

| Answer Options    | Response Count |
|-------------------|----------------|
|                   | 28             |
| answered question | 28             |
| skipped question  | 8              |

| Number | Response Date       | Response Text  | Categories |
|--------|---------------------|--|------------|
| 1      | Apr 1, 2016 8:10 PM | I learned/saw some production facilities and equipment that give me a better idea on what I need to build and cost associated with equipment                               |            |
| 2      | Apr 1, 2016 8:07 PM | use of cider specific variables in cider blends, different packaging/bottle advantages   |            |
| 3      | Apr 1, 2016 8:06 PM | learning specifics of the equipment used in cider making; enforced yeast knowledge; logical layout of cider operation  |            |
| 4      | Apr 1, 2016 8:02 PM | in general - realization that the knowledge barrier is not as imposing as once thought   |            |
| 5      | Apr 1, 2016 7:40 PM | I learned what equipment I will need to get started. What I would like to do as a tasting room and apple varieties I have to look at                                       |            |
| 6      | Apr 1, 2016 7:38 PM | insights into growing cider fruit and maximizing tannic quality of juice cellar  |            |
| 7      | Apr 1, 2016 7:32 PM | knowledge of cultivars and varieties of apples. Insight into the challenges a small cidery faces   |            |
| 8      | Apr 1, 2016 7:16 PM | tasting room setup facility setup/flow tree planting on trellis system using high density planning   |            |
| 9      | Apr 1, 2016 7:13 PM | equipment needs: orchard layout and structure  |            |
| 10     | Apr 1, 2016 7:10 PM | hope to learn more cider analysis skills on SAT  |            |
| 11     | Apr 1, 2016 7:07 PM | tasting room examples  |            |
| 12     | Apr 1, 2016 6:51 PM | temp to press best way to filter Type of tanks   |            |
| 13     | Apr 1, 2016 6:39 PM | better prepackaging quality control  |            |
| 14     | Apr 1, 2016 6:36 PM | whether or not to use maceration   |            |
| 15     | Apr 1, 2016 6:34 PM | trends, vendors, supplies  |            |
| 16     | Apr 1, 2016 6:28 PM | what consumer preferences are and what varieties cidemakers are using to make cider  |            |
| 17     | Apr 1, 2016 6:15 PM | equipment  |            |
| 18     | Apr 1, 2016 6:15 PM | knowledge of American heirloom and European apple varieties  |            |
| 19     | Apr 1, 2016 6:13 PM | add more variety of flavors  |            |
| 20     | Apr 1, 2016 6:10 PM | buy a cross floor filter I can't afford  |            |
| 21     | Apr 1, 2016 6:08 PM | just overall knowledge of how others run their operations  |            |
| 22     | Apr 1, 2016 6:07 PM | planting of heirloom varieties on rootstock  |            |
| 23     | Apr 1, 2016 6:05 PM | the many ways of marketing hard cider  |            |
| 24     | Apr 1, 2016 5:58 PM | learned more about hard cider varieties  |            |
| 25     | Apr 1, 2016 5:37 PM | networking. I will be looking at the hard cider website  |            |
| 26     | Apr 1, 2016 5:32 PM | marketing and filtration   |            |
| 27     | Apr 1, 2016 5:28 PM | I've been making hard cider for 9+ years and brewing beer for a few years before that. This is byfar most beneficial towards opening a cidery than any other job training! |            |
| 28     | Apr 1, 2016 5:21 PM | Apple variety info from folks on the tour equip. info  |            |

### 3/19/16 – Seed to Sip Hard Cider Workshop, Center Valley, PA

#### Event Data

- **44 attendees** representing 10 states.
- 19 attendees from Pennsylvania representing 49% of the audience.
- 97% of respondents indicated this event met their learning objectives
- 88% of respondents indicated they anticipate increased business profitability as a result of knowledge gained at this training.
- 72% of respondents indicated they anticipate increased business productivity as a result of knowledge gained at this training.
- 41% of respondents indicated they anticipate that they will be able to hire at least one new employee as a result of knowledge gained at this training
- 44% of respondents indicated they anticipate the ability to recognize cost savings as a result of knowledge gained at this training
- 66% of respondents indicated they anticipate increased efficiency as a result of knowledge gained at this training.

3/19/16 Hard Cider Workshop

| As a direct result of this training I will... |                |
|---|----------------|
| Answer Options                                | Response Count |
|   | 34             |
| answered question                             | 34             |
| skipped question                              | 5              |

| Number | Response Date        | Response Text  | Categories |
|--------|----------------------|--|------------|
| 1      | Mar 29, 2016 2:17 PM | do more research   |            |
| 2      | Mar 29, 2016 2:16 PM | dig deeper into hard cider   |            |
| 3      | Mar 29, 2016 2:15 PM | make a few changes in my production but nothing significant  |            |
| 4      | Mar 29, 2016 2:12 PM | continue to develop my knowledge and cidermaking skills and definitely add more trees to my orchard            |            |
| 5      | Mar 29, 2016 2:08 PM | be better informed and confident in approaching the business   |            |
| 6      | Mar 29, 2016 2:04 PM | be able to sell different options of ciders after using the tasting aspect                                     |            |
| 7      | Mar 29, 2016 2:01 PM | learn about varieties  |            |
| 8      | Mar 29, 2016 1:52 PM | more prepared to start a business  |            |
| 9      | Mar 29, 2016 1:49 PM | Have a better idea of cider making specifics, and market trends  |            |
| 10     | Mar 29, 2016 1:30 PM | work on marketing our cider brand; look into apple skins to add to fermentation                                |            |
| 11     | Mar 28, 2016 8:21 PM | continue development of business idea  |            |
| 12     | Mar 28, 2016 8:10 PM | proceed  |            |
| 13     | Mar 28, 2016 8:04 PM | feel more equipped with cider chemistry  |            |
| 14     | Mar 28, 2016 7:36 PM | Do a better job of making cider  |            |
| 15     | Mar 28, 2016 7:34 PM | make delicious cider!  |            |
| 16     | Mar 28, 2016 7:33 PM | keep practicing cider making   |            |
| 17     | Mar 28, 2016 7:00 PM | continue to make delicious cider   |            |
| 18     | Mar 28, 2016 6:57 PM | make more cider, drink more cider, sell more cider   |            |
| 19     | Mar 28, 2016 6:15 PM | be one stop closer to establishing a commercial cidery   |            |
| 20     | Mar 28, 2016 6:12 PM | start looking at hard cider production   |            |
| 21     | Mar 28, 2016 6:09 PM | have an idea of what it will take to take my glorified hobby into a business opportunity                       |            |
| 22     | Mar 28, 2016 6:07 PM | move forward with our cidery plans   |            |
| 23     | Mar 28, 2016 6:04 PM | move forward to license  |            |
| 24     | Mar 28, 2016 6:03 PM | study further  |            |
| 25     | Mar 28, 2016 5:57 PM | continue business planning   |            |
| 26     | Mar 28, 2016 5:55 PM | build a business plan  |            |
| 27     | Mar 28, 2016 5:47 PM | continue to work thru the process of obtaining a cider license   |            |
| 28     | Mar 28, 2016 5:44 PM | continue to study and apply new techniques and ideas to my cidermaking; think anew about marketing techniques. |            |
| 29     | Mar 28, 2016 5:37 PM | tweak my production methods a bit; look into a wider array and more control of juice varieties                 |            |
| 30     | Mar 28, 2016 5:34 PM | Be able to plant the correct varieties of apples to achieve the flavor profile I want for my cider             |            |
| 31     | Mar 28, 2016 5:28 PM | have greater appreciation for hard cider   |            |
| 32     | Mar 28, 2016 5:26 PM | Look at online PSU cider book  |            |
| 33     | Mar 28, 2016 4:00 PM | Start our business plan and start making some test batches   |            |
| 34     | Mar 28, 2016 3:47 PM | Start business plan for start-up   |            |

## Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

### 3/19/16 Hard Cider Workshop

Please list particular skills or knowledge gained at this training that will help you in your enterprise.

| Answer Options           | Response Count |
|--------------------------|----------------|
|                          | 30             |
| <i>answered question</i> | 30             |
| <i>skipped question</i>  | 9              |

| Number | Response Date        | Response Text   | Categories |
|--------|----------------------|---|------------|
| 1      | Mar 29, 2016 2:17 PM | tech know how   |            |
| 2      | Mar 29, 2016 2:15 PM | content marketing was the most informative as that was an area that I knew very little about  |            |
| 3      | Mar 29, 2016 2:12 PM | measuring tannins; content marketing; variety of ciders and evaluating ciders   |            |
| 4      | Mar 29, 2016 2:08 PM | steps and procedures for cidemaking; exposure to diligent production equipment; exposure to diligent test procedures; practical knowledge of test metrics and targets |            |
| 5      | Mar 29, 2016 2:04 PM | marketing/blogs/stay ahead of the google drop offs.   |            |
| 6      | Mar 29, 2016 2:01 PM | marketing online more often   |            |
| 7      | Mar 29, 2016 1:59 PM | importance of measuring malic acid and balancing pH   |            |
| 8      | Mar 29, 2016 1:54 PM | specifics about cidemaking from an expert; where to find equipment; cider tasting   |            |
| 9      | Mar 29, 2016 1:52 PM | learning specifics of acid and tannin will help lots of good production details.  |            |
| 10     | Mar 29, 2016 1:30 PM | marketing; fermentation parameters  |            |
| 11     | Mar 28, 2016 8:21 PM | Fermentation process and invaluable advice about steps/challenges   |            |
| 12     | Mar 28, 2016 7:00 PM | tannins in apple varieties  |            |
| 13     | Mar 28, 2016 6:59 PM | marketing   |            |
| 14     | Mar 28, 2016 6:57 PM | everything on Scott Topel's powerpoint  |            |
| 15     | Mar 28, 2016 6:15 PM | a much better understanding of tannins and acidity. Better cider tasting criteria under taking.   |            |
| 16     | Mar 28, 2016 6:12 PM | the check tests in every step were helpful  |            |
| 17     | Mar 28, 2016 6:09 PM | I learned a lot of tips from Scott's segment  |            |
| 18     | Mar 28, 2016 6:07 PM | greater marketing knowledge   |            |
| 19     | Mar 28, 2016 6:04 PM | variety selection of cider apples   |            |
| 20     | Mar 28, 2016 6:03 PM | many ways to grow our operation   |            |
| 21     | Mar 28, 2016 5:57 PM | understanding of acid titration and other essential lab tests. more knowledge of tanning/polyphenols; importance of blogging in addition to social media              |            |
| 22     | Mar 28, 2016 5:55 PM | marketing information, tasting  |            |
| 23     | Mar 28, 2016 5:47 PM | a lot of hands on information   |            |
| 24     | Mar 28, 2016 5:44 PM | The hard science discussed during the pressing and fermentation lesson. The palate education learned during tasting.  |            |
| 25     | Mar 28, 2016 5:37 PM | knowledge of various styles and how to achieve them.  |            |
| 26     | Mar 28, 2016 5:34 PM | understanding the flavor profiles of different apples and blends  |            |
| 27     | Mar 28, 2016 5:28 PM | the use of champagne yeasts   |            |
| 28     | Mar 28, 2016 5:26 PM | hard cider testing, titration, etc.   |            |
| 29     | Mar 28, 2016 4:00 PM | set up, start up  |            |
| 30     | Mar 28, 2016 3:47 PM | Scale size and products   |            |

### 3/19/16 Hard Cider Workshop

Please list expected impacts resulting from changes made to your business because of knowledge gained at this training.

| Answer Options           | Response Count |
|--------------------------|----------------|
|                          | 22             |
| <i>answered question</i> | 22             |
| <i>skipped question</i>  | 17             |

| Number | Response Date        | Response Text   | Categories                         |
|--------|----------------------|---|------------------------------------|
| 1      | Mar 29, 2016 2:16 PM | more networking   |                                    |
| 2      | Mar 29, 2016 2:04 PM | making more varieties of cider with a sweeter profile.  |                                    |
| 3      | Mar 29, 2016 2:01 PM | push for more products to offer to different tastes   | Possibly not carbonating the cider |
| 4      | Mar 29, 2016 1:59 PM | Consistent product  |                                    |
| 5      | Mar 29, 2016 1:52 PM | help initialize the plan  |                                    |
| 6      | Mar 29, 2016 1:49 PM | better idea of our market; a direction to head towards  |                                    |
| 7      | Mar 29, 2016 1:30 PM | evolution of cider styles; consistent branding and marketing direction                                      |                                    |
| 8      | Mar 28, 2016 8:04 PM | confidence in chemistry of cider making   |                                    |
| 9      | Mar 28, 2016 7:00 PM | increase in efficiency of cider product   |                                    |
| 10     | Mar 28, 2016 6:59 PM | specific fermentation changes - acidity adjustments   |                                    |
| 11     | Mar 28, 2016 6:57 PM | walk through all cider making processes and ensure we are as efficient as possible                          |                                    |
| 12     | Mar 28, 2016 6:12 PM | looking at adding another value added product to our farm market  |                                    |
| 13     | Mar 28, 2016 6:07 PM | great networking. we will stay in touch and visit these folks   |                                    |
| 14     | Mar 28, 2016 6:04 PM | expand sales  |                                    |
| 15     | Mar 28, 2016 5:57 PM | n/a but I'll probably adjust formulation for my sweet ciders that will be bottled                           |                                    |
| 16     | Mar 28, 2016 5:55 PM | new approaches to content marketing. Able to talk to apple growers a bit better as to what I'm looking for. |                                    |
| 17     | Mar 28, 2016 5:47 PM | speed the licensing process   |                                    |
| 18     | Mar 28, 2016 5:44 PM | Increased varietal experimental in plantings; different fermenting techniques                               |                                    |
| 19     | Mar 28, 2016 5:37 PM | higher quality product/cider  |                                    |
| 20     | Mar 28, 2016 5:34 PM | Identify and invest initial capital appropriately and increase output                                       |                                    |
| 21     | Mar 28, 2016 5:28 PM | selling more hard cider   |                                    |
| 22     | Mar 28, 2016 5:26 PM | Fermentation tank style   |                                    |



## Interest in producing and consuming locally sourced

fermented beverages—from wine to beer to hard cider to spirits—is growing throughout Pennsylvania, and Penn State Extension is providing educational support to both emerging and established businesses in the industry.

Extension's support ranges from educating producers and consumers, using the same research-based food-science principles that are applied to food safety programs, to helping local businesses create new job opportunities.

"As many counties across the state face economic challenges, fermented beverage businesses are becoming more and more integrated into their local agriculture and communities," says Denise Gardner, enology extension associate. "We're seeing a push for breweries and distilleries to source local grains, the cider industry wants to use local apples, and wineries want to create a local brand name. And that's where extension comes into play."

## Wine

Gardner travels throughout the state to meet with groups of winery owners, addressing production questions. If a particular winery has a problem or question, Gardner, who has expertise in identifying wine defects based on taste, will visit the winery and taste the wines to help troubleshoot the problem.

As well as individual visits to wineries, Gardner presents defect identification and remediation and prevention workshops to the wine industry throughout the state and beyond. Last year, for example, she conducted a workshop at Rutgers University as well as at the Eastern Winery Expo, where attendance was more than 200.

Each January, Gardner leads a wine quality improvement workshop at Penn State's University Park campus. "This is one of our primary programs, and we have people coming in from all over the country," she says. "Participants learn how to train themselves, as well as their winery cellar staff, in identifying problems."

One of the challenges for Pennsylvania wine pro-

ducers, Gardner says, is the variable weather. "Each year we deal with different climatic conditions, and you have to adapt. That creates challenges, but it also results in some unique products that you couldn't get anywhere else. The most interesting wines in the world, I think, are made in regions that are not consistent. To me, Pennsylvania wine makers who make premium wines are the most talented in the world."

Gardner is excited to see growing interest in Pennsylvania wines even beyond the state's borders. Last year, at a talk she gave in Washington, D.C., she says, "the energy was amazing. Once wine consumers develop an appreciation for not only the agricultural component, but also the unique qualities of our Pennsylvania wines, it just catches on from there."

## Hard Cider

Pennsylvania ranks sixth in the nation in hard cider production, and during the last four years the industry has grown 80 percent. Clearly, hard cider is an expanding industry in the Commonwealth. Carla Snyder, agricultural entrepreneurship and marketing extension educator, is working to provide support and education for everyone involved in the hard cider industry: from growers to consumers.

"We are developing a well-rounded, holistic program that addresses the entire range of educational and research needs," Snyder says. Extension's hard cider program includes workshops, tours for producers, and education for consumers as well as support for industry members, such as bar and restaurant owners, distributors, and sommeliers. A guidebook



Source/Source: 2011 Penn State Ag Science 23

**Large producers such as Angry Orchard make up only 56 percent of the hard cider market.**

## BEER

Pennsylvania ranks first in the nation with **4,074,883** barrels of craft beer produced per year.

**136** craft breweries

We have the **OLDEST** brewery in the United States. **1829**

**\$4.5** million economic impact

## WINE

**\$1.8** billion economic impact

Pennsylvania is the fifth-largest wine grape producer in the U.S. **10,278,722** gallons of wine produced

## SPIRITS

Number of distilleries in Pennsylvania prior to prohibition.

**1,200**

Number of Pennsylvania distilleries today. **30**

**100,000** gal. Annual production permitted per distillery by law

24 Penn State Ag Science Source/Source: 2011

magazine.

Pages from Penn State Ag Science

### Beneficiaries:

The results of this project benefitted our entire grower membership—approximately 270 growers as the growth of the cider industry will continue to create demand for all types apple varieties for processing. It also benefits existing cider producers as well as new producers that are not also growers. This information is also valuable to growers of pears, and berry producers.

### Lessons Learned:

This project was incredibly valuable. It identified both immense opportunities for growers and cider producers, but also gaps in production and regulatory knowledge and producers' understanding of how to connect with consumers. It also quantified the growth of this emerging beverage segment as well as potential growth trends.

**Pennsylvania ranks 6<sup>th</sup> in the nation for hard cider production and has grown by 80% in the last four years**, but until this project was funded there was not a consolidated resource for producers and/or growers. The workshops and tangible results of the scope of this project have resulted in a new comprehensive Extension program that focuses on hard cider that encompasses growing the apples, producing the cider and marketing the product.

As a result of the workshops sponsored by this project, **75% of participants indicated increased profitability of 25%** after completing a workshop and **13% reported they were able to create at least one new job** as a result of knowledge gained through workshop sessions. Additionally, the results have quantified the opportunities for apple growers. This value-added

|                  |   |
|------------------|---|
|                  | <p>opportunity creates new outlets for apples that may not be suitable for the fresh market and for varieties that are better suited for processing.</p> <p>This project highlighted the need for additional research and education ranging from cider varietals studies, to further helping producers navigate regulatory challenges and additional consumer education.</p> <p>Despite the opportunities, growers and producers will still have the challenge of Pennsylvania's liquor codes and the fact that cider is not currently recognized as its own beverage category or agricultural commodity. But this project has proven that despite the regulatory and distribution challenges in Pennsylvania, producers are still finding ways to have success. This is largely due to the fact that Pennsylvania ranks 4<sup>th</sup> in the country for apple production and as a result of this project over the last two years, growers and producers now have access to aggregated resources.</p>   |
| Contact:         | <p>Julie Bancroft<br/>Executive Director   PA Apple Marketing Program<br/><a href="mailto:julie@pennsylvaniaapples.org">julie@pennsylvaniaapples.org</a><br/>717.783.5418</p>   |
|                  |   |
| <b>Project 8</b> | <b>Sustainable Production, Pest Management, and Market Innovations for Next Generation Specialty Crop Producers from Diverse Backgrounds</b>  |
| Project Summary: | <p>A Penn State Extension multidisciplinary project team created and tested educational programming for under-served growers, namely Hispanic and young individuals interested in a career in horticultural production. These groups represent a promising next generation of successful specialty crop growers. Team members developed and evaluated the effectiveness of various classroom and hands-on teaching methods, using tree fruit and vegetables as example crops. Andragogies (teaching strategies for adult learners) were evaluated using post-program surveys and interviews. The project was guided by an advisory panel of industry stakeholders, Pennsylvania Department of Education representatives, and university faculty. Goals were to assist young specialty crop family members and Latino horticulturists in: 1) targeting local niche and value-added markets, 2) increasing environmental and socio-economic sustainability of their specialty crop enterprises, and 3) developing pest control strategies to safeguard the environment and human health.</p> <p><b>Background.</b> Pennsylvania's specialty crop industry is supported by dedicated members of family farm enterprises—some three to seven generations strong—and a rising generation of aspiring Latino horticulturists. To secure the long-term viability of this agricultural sector, research and educational programs should be tailored specific to the needs of young, new, and minority growers. In a California study of farm family succession, Giraud and Baker (2005) recommended that university extension educators focus new programming on assisting next generation growers and their families in identifying goals and preparing business and market plans. In surveys conducted by Penn State Extension, young specialty crop producers returning to the family enterprise indicated additional needs for training in sustainable production and pest management practices. The value of production and farm management training for Spanish speakers also has been demonstrated. In Washington State tree fruit producing</p> |



|                   |   |
|-------------------|---|
|                   | <p>regions, the Latino population is a growing pool for future horticulturists. A survey of Washington agricultural workers found that employees truly liked their jobs, with 96% of respondents saying they would continue working in agriculture if it continued to provide for their families (Mullinix et al., 2006). The majority also felt they could achieve a better life working in agriculture, and an additional 32% said they could achieve a better life in agriculture with more education. The best opportunities were perceived to be in farm ownership (39%), with 28% citing farm management as a professional possibility. A project to support Hispanic horticulturists in New York—GrowNYC FARMroots—has provided 190 aspiring farmers basic business planning and production education since 2001. As a result, 23 new and minority producers and their families started their own farm businesses, selling a variety of specialty crops at nearly 60 farmers markets throughout New York City and the Hudson Valley. Prior to the start of this project, case study interviews and surveys conducted locally indicated that the interests uncovered in Washington and willingness exhibited by FARMroots graduates also exists in Pennsylvania and that research and education were needed to support next-generation family and Latino farmers in pursuing and starting specialty crop operations of their own.</p> <p><b><i>Project importance and timeliness.</i></b> The <u>2012 U.S. Census of Agriculture</u> suggests there is an unsatisfied demand for education and research to support young and Latino farmers, with the average farmer age being 56 and a 21% increase in farms owned by Latinos from 2002 to 2012. The <u>2012 PA values of vegetable and fruit production</u> are \$112,131,000 and \$180,149,000, respectively. For every 1% increase, there would be a \$3 million contribution to the state’s economy. Next generation growers in surrounding states have also participated in workshops conducted in Spanish and English. The 2012 Census value of Mid-Atlantic specialty crops (including nursery and greenhouse crops) is \$6,653,045,000, of which 1% is produced by Latinos and younger growers. For every 1% increase, there would be a \$66 million contribution to the regional economy.</p> |
| Project Approach: | <p>The “Next Generation Specialty Crops” project addressed the need of enhancing the ability of the Pennsylvania fruit and vegetable industry to increase capacity and sustain such capacity by increasing the number of growers and supporting more economical and sustainable methods by a next generation of fruit and vegetable producers. Emphasis was on the overarching specialty crop focus area of education/research and outreach, and the educational activities addressed priorities including innovative marketing, sustainable production, and integrated pest management. Penn State Ag Entrepreneurship members of our team developed an Extension curriculum introducing niche marketing to young growers returning to family horticultural operations and Latino growers interested in specialized horticultural management or start-up opportunities. Horticulture and Integrated Pest Management Extension team members addressed an increased interest in integrated fruit production (IFP) and organic vegetable production among next generation growers. In cooperation with grower stakeholders, on-farm demonstration trials were established in commercial-scale vegetable plantings, and training resources and field classroom programs on IFP scouting procedures were developed. Pesticide Education Program and Horticulture team members expanded a new and successful certificate program for young and Latino growers by providing trainings on orchard pests, diseases, and beneficial organisms; protecting pollinators; and</p>   |

|                              |   |
|------------------------------|---|
|                              | <p>precision spray application procedures to safeguard the environment and human health. The three program areas were complementary, and many workshops were multi-disciplinary. For example, courses on IFP complemented courses on identifying market niches, since IFP “ecologically grown” certification programs enhance entry into new markets. Bi-lingual Extension educators were involved in each initiative, and programs were offered in both Spanish and English.</p>   |
| Goals and Outcomes Achieved: | <p>Significant progress was made toward the goals of assisting young specialty crop family members and Latino horticulturists in:</p> <ol style="list-style-type: none"> <li>1) targeting local niche and value-added markets,</li> <li>2) increasing environmental and socio-economic sustainability of their specialty crop enterprises,</li> <li>3) developing pest control strategies to safeguard the environment and human health.</li> </ol> <p>A longer range goal of the project team is to use the results from this pilot investigation to provide research-based support for a Penn State Extension curriculum for “next generation” growers that has long-term impacts on the state and regional economy. The curriculum already developed through this project is posted at the <a href="#">Penn State Extension “Start Farming – Support for the Next Generation of Farmers” website</a>, under <a href="#">“Courses and Workshops.”</a></p> <p><b><u>Next Generation Curriculum Developed/Expanded as a Result of PDA Funding</u></b></p> <p><b>Young Next Generation</b><br/>         You are taking over the family operation, developing your new enterprise and innovating production practices.<br/> <a href="#">In-depth Young Grower Workshops</a><br/> <a href="#">Young Grower Alliance Network Tours</a></p> <p><b>Next Generation Hispanic</b><br/>         You want to develop your agricultural career toward skilled labor, management and ownership. La mayoría de los oportunidades aquí son en Español y en Ingles.<br/> <a href="#">Bi-lingual Study Circle Networks</a><br/> <a href="#">Fruit and Vegetable Convention Spanish Track</a></p> <p><b><i>Project objectives and activities (listed by goal)</i></b></p> <p><b>1. Market Innovations</b></p> <p><b>Obj. 1. Increase next generation skills in identifying appropriate markets for their farm-fresh and value-added horticultural products</b><br/>         Bi-lingual courses were designed to guide next-generation Latino horticulturists in assessing internal and external factors that pinpoint the appropriate niche or specialty market for their products. Four Study Circles on identifying appropriate markets were held for Adams County producers involved in the model demonstration plots described in Goal 2, Objective 2. One hundred percent of study circle program participants indicated the interactive programming about assessing markets (e.g., interviews of potential buyers and role play on connecting with buyers) helped them assess the best crops to grow based on potential profitability. <a href="#">Bilingual Study Circle</a> instructors and Latino learners conducted a market study of local Mexican stores and restaurants and the results are posted at <i>Penn State Extension Start Farming</i>, <a href="#">“Identifying</a></p> |

Markets for Hispanic Produce Growers.” One state-wide workshop course in Spanish was held, and of 23 participants who completed a post-program survey, 52% said they planned to give increased attention to market factors that improve farm profits.

**Obj. 2. Expand next generation producers’ knowledge of market trends in consumer preferences so that specialty crops chosen and produced may meet or be ahead of customer demand**

Young, new, and minority producers learned how to use on-line resources to learn about, and benefit from, food trends as they built custom marketing strategies. Two “Learn-Now” modules were launched in October, 2015. “Food Business Innovation: Using Social Media” introduces next generation growers to the practice of using social media networks as tools for conducting market research. Advantages and disadvantages to social media market research are discussed, followed by how engagement measures, such as “likes” and “shares,” can be used to analyze consumer mindset. “Innovating your Food Business” describes how all food products have life cycles, from exciting launch through slow decline. This video shows how to get inspiration to re-energize a business and grow the market share.

**2. Sustainable Production**

**Obj. 1. Increase next generation sustainable production skills by developing integrated fruit production (IFP) orchard scouting resources and training programs**

Next generation specialty crop growers of diversified crops, grown in sustainable systems for local and niche markets, learned advanced strategies for monitoring crop status and predicting the potential for pest and disease occurrence. During two bilingual courses on IFP conducted for 125 producers, 88% of English speakers and 92% of Spanish speakers said they planned to apply a new IFP strategy on their farm. Two field training sessions on orchard scouting (using European red mite and apple scab as examples) were held for 48 young growers. In a post-program survey, 85% indicated they would apply what they learned about disease and insect life cycles, and 100% said they would be interested in attending future scout training sessions. Fact sheets and scouting report forms, in English and Spanish, were developed for the IFP field trainings, and they are posted at the Penn State Extension Tree Fruit Production website with links at Start Farming. The first in a series of commercial tree fruit production videos was produced, and plans are to utilize it as part of an on-line course for commercial tree fruit producers. Blogs on European red mite scouting and monitoring for apple scab were also posted. A bilingual, waterproof IPM guide, titled *A Field Guide to Tree Fruit Disorders, Pests, and Beneficials* was developed in support of these courses and field trainings. To date, the field guide has been distributed to 575 growers. In post-program surveys, Spanish session attendees indicated they found the guide useful in identifying disorders before they became a serious problem, permitting more timely control of pests and diseases. English session attendees made a similar observation and recommended that similar guides be developed for other crops.

**Obj. 2. Engage young and Latino growers in conducting on-farm sustainable vegetable production trials and utilize these plots as living classrooms**

Extension faculty worked with new Latino growers in two locations in the state (Adams and

Northampton Counties) to implement innovative, sustainable techniques and assess their impacts on farm economics and environmental sustainability. Resources developed for this objective included videos on [Soil Health in Orchards](#), [Orchard Bio-renovation](#) and [Vegetable Scouting](#). (Additional information on the videos is under objective 3.)

**Northampton County Model Plot and Study Circle Networks.** Team members collaborated with farmer Lexy Rodriguez at the Easton Farm to demonstrate good farming practices including soil fertility and preparation, transplanting, irrigation, integrated pest management (IPM), and proper harvest for food safety and post-harvest quality. Cooperating with the farmer to transform the vegetable production site into a model plot improved the sustainability and productivity on the farm and created a space for aspiring Latino farmers to learn and collaborate. Six [bi-lingual Study Circles](#) were conducted at the model plot, including a program on [Exploring the Small Farm Dream](#), and hands-on living classroom sessions on transplanting, rotation planning, wash station construction, scouting and managing pests, harvest and post-harvest practices and food safety. As a result of the learning circle network series, 100% of participants learned a good or great deal (n=10). Latino growers said they learned “about bacteria and how to be careful with the vegetables,” “not to replant tomatoes in the same spot year after year,” “how to be systematic and follow instructions about food safety,” and “at what temperature to store tomatoes.” Comments about teaching methods included: “we enjoyed the experience and learned a lot;” “it was excellent learning in Spanish and having other Spanish people in the class – a fantastic opportunity;” and “we should have these sessions more often!”

**Adams County Model Plot (Amigos Farm) and Study Circle Networks.** Horticulture and Ag Entrepreneurship team members worked with three new Latino farmers to help them start their own farm. Through one-on-one mentorship and intensive group sessions they grew five crops in their “model plot” farm: tomatoes, bell peppers, hot peppers, lettuce, and onions. Educators Tianna DuPont, Montserrat Fonseca Estrada, Marley Skinner, and/or Miguel Saviroff worked with the growers on a bi-weekly basis throughout the growing season in order to make sure that good farming practices were followed from soil preparation to harvest. The plot served as a living classroom not only for the Amigos Farm participants but also for a larger group of existing and aspiring Latino farmers. For example, two growers from the Amigos Farm project shared what they had learned about part-time farming with Latino families who had garden plots at the Gettysburg College [Painted Turtle Farm](#). Eleven study circles covered topics such as cover crops, pricing and markets, weed management, staking and trellising peppers and tomatoes, integrated and organic pest management, farm stand set-up, post-harvest handling and storage of onions, and budgets and business management. Following the study circle at the Painted Turtle Farm, 100% of participants (n=7) said they learned new information and practices such as to use new stakes and field supplies to avoid disease and how to look at a plant to look for symptoms, and 70% of participants said they plan to do something new after what they learned. For example, two participants planned to use new stakes every year to prevent bacterial disease in tomatoes without sprays.

**Key Competencies.** Amigos Farm participants improved their knowledge and skills in five or

more key competency areas including soil fertility and cover cropping, plant culture and care, pest and weed management, farm management and marketing. For example at the beginning of the season one grower had no exposure to soil testing and fertilizing and during the season not only saw and talked about fertility but fertilized his field with help. Participants improved their competency in: irrigation; season extension; insect and disease identification, monitoring and control; mulching and cultivating for weed management; record keeping and direct marketing. Participants said: “I learned how to fertilize to make the plants strong,” “I want to learn more about pest and disease management,” “It was great because we saw for ourselves what happened if we did not stake the tomatoes or follow other practices (the plants fell)—we learned quickly,” “knowing the budgets and what money we made was important,” “if I have a chance I will continue—I would love to have a farm next year,” “before I was not interested in the disease management, but after seeing it I feel responsible for the plants and want to learn,” “the most important was the sales.”

**Obj. 3. Increase access to research-based Extension production recommendations by expanding website content for young, new and minority specialty crop producers**

This objective was met (using other funding sources), even though it had to be dropped from the one-year proposal due to a decreased level of funding. Extension horticulturists increased specialty crop website content available for this large group of interested new producers and developed various formats of resources in Spanish. The website content is provided under specific subject matter headings above. Start Farming web-based programs were accessed by 32,500 per month (target was 15,000). Comprehensive Resources in Spanish went up at the Start Farming website in 2015, and this has been a highly viewed site, with over 7000 page views in the first nine months.

**3. Pest Management and Pesticide Education**

**Obj. 1. Expand a new and successful certificate program for young and Latino growers to increase safe handling of pesticides**

Pesticide safety educational materials and trainings in English and Spanish were developed on proper chemical selection based on pest identification and the need to protect beneficial organisms and human health. Three certificate courses for 153 producers were conducted and one additional course is planned. Knowledge gained was evaluated through case studies, and over 90% of participants successfully solved a case study on protecting pollinators. Evaluations also included questions on planned adoption of new practices. Over 80% of participants planned to use improved pesticide handling practices, and 78% indicated they would apply a new environmental protection practice.

**Obj. 2. Expand opportunities for English and non-English speaking specialty crop employees in becoming specialized horticultural crop managers**

Team members cooperated with local migrant education and literacy programs to develop and conduct bilingual training programs to prepare horticultural managers to learn to scout their orchards and to take the Pennsylvania Pesticide Applicator Certification private applicator exam. This objective provided additional support for Goal 2, Objectives 1 and 2. Goals 2 and 3 project leaders jointly developed four videos – Integrated Pest Management in

Orchards, Soil Health in Orchards, Orchard Bio-Renovation, and Vegetable Scouting. The two IPM videos were produced in both Spanish and English. All videos are posted at team websites and Start Farming, and future plans are to include them in on-line courses for young and Latino growers as well as in on-line pesticide education courses.

**Research on Andragogy Principles and Best Extension Practices for Young and Latino Learners**

Surveys to determine learning preferences were conducted at three specialty crop educational programs conducted for Latino learners and three programs for young learners. The top-rated ways of learning for Latino growers (n= 63) were 1) on-farm demonstrations and learning circles, 2) special presentations during meetings they already attend, 3) in-depth workshops, 4) on-line courses (once available), and 5) tours of other growers' farms. The top-rated ways of learning for young growers (n=44) were 1) on-farm demonstrations and learning circles, 2) tours of other growers' farms/research stations, 3) in-depth workshops, 4) special presentations during meetings they already attend, and 5) on-line courses (once available from Penn State). Top-rated ways extension and other ag professionals might increase/improve education and engagement with Latino growers were to 1) increase use of social media for outreach and extension, 2) hold educational events at the farms of Latino growers, 3) hold some educational programs specifically for Latino farmers – to increase networking opportunities, 4) provide interactive formats at educational events, such as hands-on/problem solving activities and field walks, 5) provide opportunities to network with extension personnel and other ag providers, and 6) invite Latino growers to participate in educational events as round table members or mentors. Top-rated ways extension and other ag professionals might increase/improve education and engagement with young growers were to 1) hold educational events at the farms of young growers, 2) provide interactive formats at educational events, such as hands-on/problem solving activities and field walks, 3) show that you take young growers seriously through personal contact, 4) provide opportunities to network with extension personnel and other ag providers, and 5) hold some educational programs specifically for young growers – to increase networking opportunities. Factors Latino grower survey respondents felt limited them from participating in educational activities/utilizing extension resources were 1) timing of program/ workshop (offered during planting, harvest, etc.), 2) cost, and 3) location. Factors young grower survey respondents felt limited them from participating in educational activities/utilizing extension resources were 1) timing of program/ workshop (offered during planting, harvest, etc.), 2) topics not relevant, and 3) location. These results will be reported in extension and grower publications and also be used to guide future extension programming for young and Latino specialty crop growers.

Focus group sessions were held during several stakeholder advisory meetings, and young and Latino growers were asked how they liked to learn. Participants said they preferred hands-on, problem-solving extension approaches that involved opportunities to network with other growers. Suggested strategies included on-farm trials where both production and economic performance were compared, apprenticeships/working visits with established farmers, and hands-on demonstrations such as pruning and IPM scouting. The growers placed a high value on learning environments that allowed for relevant networking with other growers. The

consensus was that learning opportunities should be a mix of in-depth workshops and local study circles along with self-paced on-line courses. On-line courses should be highly visual and include short “how to” videos.

The focus group growers also shared experiences that inspired them to adapt new practices on their farms. Common answers were “hearing and seeing what other farmers were doing during tours,” “hands-on courses,” “on-farm trials with economic data,” “winter meetings and conferences,” “webinars,” “having a farmer mentor,” and “visits by extension educators.” During discussions surrounding both questions, growers commented on the equal importance of science-based recommendations in production guides, newsletters, and production alerts.

#### Work Plan Accomplishments

| Goal & Obj.               | Activity  | Significant Results  |
|---------------------------|---|--|
| <b>Goal 1.<br/>Obj. 1</b> | Develop and deliver a hands-on training session to introduce Hispanic growers to tools for making business decisions and how to assess appropriate market opportunities.  | 3 model plot growers developed a business plan and assessed best market opportunities. A market study of local Mexican stores and restaurants was conducted, and the results are posted at Penn State Extension Start Farming, “Identifying Markets for Hispanic Produce Growers.” |
| <b>Goal 1.<br/>Obj. 2</b> | Provide on-line training for next generation growers, introducing the use of social media and specific food-innovation web sites to learn about potential markets for their products and to serve as launching boards for innovative placement and promotion for what they produce. | Two Learn-Now modules developed and posted in October, 2015.   |



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|  | <p><b>Goal 2.</b></p> <p><b>Obj. 1</b> Develop an electronic series of fact sheets, training modules, and Integrated Fruit Production (IFP) scouting forms, in English and Spanish, which can be printed out and organized as an orchard monitoring manual. Conduct hands-on field trainings at various times during the season when new practices can best be demonstrated.</p> <p><b>Goal 2.</b></p> <p><b>Obj. 2</b></p> <p>Cooperate with Latino vegetable growers to establish demonstration trials on ground cover and soil management systems. Utilize the research sites as “study circle networks.”</p>        | <p>During two bilingual courses on IFP conducted for 125 producers, 88% of English speakers and 92% of Spanish speakers said they planned to apply a new IFP strategy on their farm. Two field training sessions on orchard scouting (using European red mite and apple scab as examples) were held for 48 young growers. 85% indicated they would apply what they learned. Web-based programs were accessed by 32,500 per month; target was 15,000.</p> <p>As a result of the learning circle network series, 100% of participants learned a good or great deal, and 100% plan to apply 2 to 4 new practices.</p>  |
|  | <p><b>Goal 3.</b></p> <p><b>Obj. 1</b> Compare a diversity of educational approaches for pest control, chemical selection, and safe application, including classroom lectures, hands-on demonstrations, and field based demos. Develop videos (English and Spanish) for on-line courses on IPM.</p> <p><b>Goal 3.</b></p> <p><b>Obj. 2</b> Working with a migrant education intermediate unit, develop multiple educational approaches in Spanish and English for pre-exam training for private applicator certification, including face-to face classroom instruction, web-based training, and field- based demos.</p> | <p>Three certificate courses for 153 producers were conducted and one additional course is planned. Over 80% of participants planned to use improved pesticide handling practices, and 78% indicated they would apply a new environmental protection practice. Videos will be incorporated into on-line training for pesticide applicators.</p> <p>32% of participants said they passed the pesticide applicator exam as a result of program training.</p> <p><b>The top-rated ways of learning for Latino growers (n= 63) were 1) on-farm demonstrations and learning circles, 2) special presentations during meetings they already attend, 3) in-depth workshops, 4) on-line courses (when available),</b></p> |

and 5) tours of other growers' farms. The top-rated ways of learning for young growers (n=44) were 1) on-farm demonstrations and learning circles, 2) tours of other growers' farms/research stations, 3) in-depth workshops, 4) special presentations during meetings they already attend, and 5) on-line courses (when available from Penn State).

#### Significant Contributions and Roles of Project Partners

| Goal           | Team Leaders and Cooperators   | Contributions and Roles   |
|----------------|--|---|
| <b>Goal 1.</b> | <p>Winifred McGee, Sarah Cornelisse (Penn State Extension Ag Entrepreneurship Team)</p> <p>Miguel Antonio Savioff (Penn State Extension Ag Entrepreneurship Team), Tianna Dupont, Montserrat Fonseca Estrada (Penn State Extension Horticulture Team)</p>      | <p>Developed on-line training for next generation growers, introducing the use of social media and specific food-innovation web sites to learn about potential markets for their products.</p> <p>Delivered a hands-on training session to introduce Hispanic growers to tools for making business decisions and how to assess appropriate market opportunities.</p>      |
| <b>Goal 2.</b> | <p>Tara Baugher (Penn State Extension Horticulture Team), Maria Gorgo Gourovitch, (Penn State Extension Integrated Pest Management Team)</p> <p>Tianna Dupont, Montserrat Fonseca Estrada, Marley Skinner, Patty Neiner (Penn State Extension Horticulture</p> | <p>In cooperation with Penn State plant pathology and entomology specialists, developed IFP training materials and conducted hands-on field trainings on orchard scouting.</p> <p>Established model plots with Latino growers in two regions of the state and utilized the plots as living classrooms, called "study circle networks." Developed Learn Now courses on</p> |

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|  | Team), Jorge Perez-Rico, IPM.<br>Suzanne Benchoff (PA<br>Department of Education<br>migrant program)  |  |   |   |   |
| <b>Goal 3.</b>   | Kerry Richards, Hector Nunez-Contreras, Kelly Over (Penn State Extension Pesticide Education Program); Tara Baugher, Montserrat Fonseca Estrada, Tianna Dupont (Penn State Extension Horticulture Team) | Expanded a new and successful certificate program for young and Latino growers by providing trainings on orchard pests, diseases, and beneficial organisms; protecting pollinators; and precision spray application procedures to safeguard the environment and human health. Developed videos on vegetable and orchard scouting, soil health, and bio-renovation. |   |   |   |
| <b>Progress toward Achieving Expected Measurable Outcomes</b>  |   |  |   |   |   |
| <b>Project Goal</b>  | <b>Outcomes</b>   | <b>Measures</b>  | <b>Benchmarks</b>   | <b>Targets</b>  | <b>Mon<br/>P</b>  |
| <b>Enhance the ability of the specialty crop industry to increase and sustain capacity by increasing the no. of growers and supporting more economical and sustainable methods by a next generation of producers</b> | Increased no. young and Latino growers  | No. of next gen. growers/specialized manager program participants  | Recent ag census numbers  | 230 next gen. and specialized manager program participants (200 was target)         | Each educational program evaluation using questions to document |
|  | Increased acreage and value of local fruits and vegetables  | Acreage and approx. value of new production  | Recent ag census values   | Est. 4400+ acres; \$700,000 in crop value (based on 5% increase of ag census value) | target change. Result teaching method young minor               |
|  | Increased adoption of best practices  | No. new marketing or production practices  | Current marketing and production practices                      | 52-92% of participants adopted 2 new practices (80% was target)                     | grower shared extension stakeholder public                      |
|  | *Increased access to educational programs for young and minority  | No. page views at Penn State Extension new grower website  | 1-2000 page views per day reaching 13,000 new growers per month | Web-based programs accessed by 32,500 per month; target was 15,000                  |   |

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|                  | growers  |  |
|                  | <b><i>* This objective was met (leveraging this grant to obtain other funding sources), even though it had to be dropped from the one-year proposal due to a decreased level of funding.</i></b>   |  |
| Beneficiaries:   | <p>The specialty crop beneficiaries of the project include an aging generation of producers, fresh produce marketers who perceive demand exceeding supply of local fruits and vegetables, food insecure Pennsylvanians striving to improve their diets with fresh fruits and vegetables, and a rising generation of aspiring young and Latino horticulturists.</p> <p>Approximately 230 young, new, and minority producers with an estimated 4400 acres increased the supply of local food—a potential contribution of \$700,000 in crop value to the local economy, based on a 5% increase of ag census value. Fifty-two to 92% of participating producers implemented two to four new marketing or production practices to improve the long-term sustainability of their farms.</p>                  |  |
| Lessons Learned: | <ul style="list-style-type: none"><li>• Programs on business management were most successful when production topics were also included. Young and Latino learners valued mentorship by experienced farmers.</li><li>• Model plots and study circle networks were the tenets for successful application of a New and Beginning Farmer Program grant to continue extension programming for young, new and Latino growers.</li><li>• Social media and video materials tailored specific to the needs of young, new, and minority growers were even more widely accepted and utilized than anticipated.</li><li>• To reach more Latino growers, some of our future programs will be conducted in conjunction with PA Department of Education out-of-school youth training by intermediate units.</li></ul> |  |
| Contact Person:  | Tara A. Baugher, Penn State Extension Educator<br>717-334-6271, ext. 314<br><a href="mailto:tab@psu.edu">tab@psu.edu</a>   |  |
|                  |  |  |
| Project 9        | Marketing and Accessing More Specialty Crops in Fayette County   |  |
| Project Summary: | <p>According to the Center for Disease Control, Fayette County is ranked #1 in Pennsylvania for diabetes. Residents and consumers in this area need better access and consumption of fresh fruits and vegetables. Additionally, other than the Fayette County Farmers Markets and some farmer-owned, road-side markets, there are very limited venues for consumers to direct purchase locally grown fruits and vegetables. The project was designed, in part, to help</p>   |  |

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|                   | <p>combat this serious health issue by helping consumers identify where they could access the produce and understand the health and economic benefits of purchasing specialty crops. The project also provided local farmers with a direct outlet and marketing/promotion assistance for selling their fruits and vegetables to daily consumers, thereby justifying the need for increasing specialty crop production.</p> <p>The project's focus was to market and rebuild our local food system and promote increased production and consumption of specialty crops.</p>  |
| Project Approach: | <p>Two primary objectives were established that would assist in the primary focus of marketing, rebuilding, increasing production and the consumption of specialty crops, i.e. 1) Providing residents and visitors' access to, and encourage, the consumption of locally grown fruits and vegetables; and 2) Encouraging farmers to produce more specialty crops and to supply the residents and consumers of Fayette County.</p> <p>Fay-Penn developed, coordinated and implemented a number of activities in support of the stated objectives listed above. The project was expected to be conducted for a two-year term. However, Fay-Penn underwent numerous changes, including a reorganization of its staff, a shift in priority programs, and a shift in where limited resources are allocated. This change resulted in the elimination of its Local Economy Department prohibited the organization from completing the final year of the Special Crop Grant program.</p> <p>What follows is a list of activities undertaken during year one of the grant period:</p> <ul style="list-style-type: none"> <li>• Weekly farmer's markets were held in Connellsville and Uniontown (the County's only two cities) during the July – September season. Weekly attendance ranged from 126 to 225 people for Uniontown and from 85 to 132 for Connellsville. The number of people observed purchasing fruits and vegetables ranged from 50 to 85 for Uniontown and from 70 to 100 for Connellsville. Local vendors also benefitted from Fay-Penn's efforts, including eight farmers, three local wineries, two bakers, two crafters, one apiary, and one food hub, which sourced fruits and vegetables from ten regional farms and also sold value-added products made in their commercial kitchen.</li> <li>• A marketing plan was developed and implemented in support of these events. The plan included newspaper and radio ads, yard signs, flyers, social media posts and distribution, etc.</li> <li>• Surveys and log sheets were created and collected to gather pertinent information regarding level of knowledge, needs, wants, participation, economic impact, etc.</li> <li>• Three (3) healthy cooking demonstrations were conducted during farmers' markets and at least 200 people were surveyed about healthy eating and consumption of fresh fruits and vegetables.</li> <li>• Fay-Penn partnered with the Penn State Cooperative Extension of Fayette County to</li> </ul> |

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|                                     | <p>support their efforts in conducting educational children’s activities at both markets. The activities were held every week at the Uniontown Market and from August 1<sup>st</sup> through September 12<sup>th</sup> at the Connellsville Market. The focus of each activity was on specialty crops grown in Pennsylvania with an average number of participants of 12 children per week.</p> <p>Overall, the primary objectives were met as more residents had access to, and were encouraged to purchase and consume, locally grown fruits and vegetables. Through increased consumer traffic and sales, farmers learned what types of specialty crops were in demand so they could produce more of those crops for local consumption. Although vendors other than local farmers participated in the farmer’s markets, all of the advertisements and promotional pieces focused solely on locally grown fruits, vegetables and specialty crops. No specific vendor or product was promoted.</p> <p><b>PROJECT PARTNERS/SIGNIFICANT CONTRIBUTIONS:</b> The Uniontown Redevelopment Authority and the City of Uniontown were integral partners for the Uniontown Farmers’ Market. The Uniontown Main Street Program, which is housed under the Uniontown Redevelopment Authority and the Downtown Business District Authority, organized and managed the Storey Square Summer Concert Series in conjunction with the markets. The Uniontown Main Street Manager contributed significantly to the success of the new programs and assisted in the set-up by garnering volunteers from the local high school. They also assisted with street closures, security guards, and marketing.</p> <p>The Connellsville Redevelopment Authority, Fayette Cultural Trust, and Downtown Connellsville program were major partners for the Connellsville Farmers’ Market. The Connellsville Redevelopment Authority and Fayette Cultural Trust assisted with securing the location of the market and promoted the farmers’ markets within the community and beyond. They also assisted Connellsville Area Community Ministries, a religious non-profit serving the disadvantaged in the community, in receiving a grant to provide vouchers to families to receive food. Each family received two \$5 vouchers each week to purchase fresh fruits and vegetables at the farmers’ markets.</p> |
| <p>Goals and Outcomes Achieved:</p> | <p>Two primary objectives were established that would assist in the primary focus of marketing, rebuilding, increasing production and the consumption of specialty crops, i.e. 1) Providing residents and visitors’ access to, and encourage, the consumption of locally grown fruits and vegetables; and 2) Encouraging farmers to produce more specialty crops and to supply the residents and consumers of Fayette County.</p> <p>Fay-Penn developed, coordinated and implemented a number of activities in support of the stated objectives listed above. The project was expected to be conducted for a two-year term. However, Fay-Penn underwent numerous changes, including a reorganization of its staff, a shift in priority programs, and a shift in where limited resources are allocated. This change resulted in the elimination of its Local Economy Department prohibited the organization from completing the final year of the Special Crop Grant program.</p>   |

What follows is a list of activities undertaken during year one of the grant period:

- Weekly farmer’s markets were held in Connellsville and Uniontown (the County’s only two cities) during the July – September season. Weekly attendance ranged from 126 to 225 people for Uniontown and from 85 to 132 for Connellsville. The number of people observed purchasing fruits and vegetables ranged from 50 to 85 for Uniontown and from 70 to 100 for Connellsville. Local vendors also benefitted from Fay-Penn’s efforts, including eight farmers, three local wineries, two bakers, two crafters, one apiary, and one food hub, which sourced fruits and vegetables from ten regional farms and also sold value-added products made in their commercial kitchen.
- A marketing plan was developed and implemented in support of these events. The plan included newspaper and radio ads, yard signs, flyers, social media posts and distribution, etc.
- Surveys and log sheets were created and collected to gather pertinent information regarding level of knowledge, needs, wants, participation, economic impact, etc.
- Three (3) healthy cooking demonstrations were conducted during farmers’ markets and at least 200 people were surveyed about healthy eating and consumption of fresh fruits and vegetables.
- Fay-Penn partnered with the Penn State Cooperative Extension of Fayette County to support their efforts in conducting educational children’s activities at both markets. The activities were held every week at the Uniontown Market and from August 1<sup>st</sup> through September 12<sup>th</sup> at the Connellsville Market. The focus of each activity was on specialty crops grown in Pennsylvania with an average number of participants of 12 children per week.

Overall, the primary objectives were met as more residents had access to, and were encouraged to purchase and consume, locally grown fruits and vegetables. Through increased consumer traffic and sales, farmers learned what types of specialty crops were in demand so they could produce more of those crops for local consumption. Although vendors other than local farmers participated in the farmer’s markets, all of the advertisements and promotional pieces focused solely on locally grown fruits, vegetables and specialty crops. No specific vendor or product was promoted.

**PROJECT PARTNERS/SIGNIFICANT CONTRIBUTIONS:** The Uniontown Redevelopment Authority and the City of Uniontown were integral partners for the Uniontown Farmers’ Market. The Uniontown Main Street Program, which is housed under the Uniontown Redevelopment Authority and the Downtown Business District Authority, organized and managed the Storey Square Summer Concert Series in conjunction with the markets. The



Uniontown Main Street Manager contributed significantly to the success of the new programs and assisted in the set-up by garnering volunteers from the local high school. They also assisted with street closures, security guards, and marketing.

The Connellsville Redevelopment Authority, Fayette Cultural Trust, and Downtown Connellsville program were major partners for the Connellsville Farmers' Market. The Connellsville Redevelopment Authority and Fayette Cultural Trust assisted with securing the location of the market and promoted the farmers' markets within the community and beyond. They also assisted Connellsville Area Community Ministries, a religious non-profit serving the disadvantaged in the community, in receiving a grant to provide vouchers to families to receive food. Each family received two \$5 vouchers each week to purchase fresh fruits and vegetables at the farmers' markets.

**GOALS AND OUTCOMES ACHIEVED:**

**Work Plan Goal 1:**

- **Create a log and database for monitoring the number of people attending Fayette County farmers markets that are purchasing fruits and vegetables.**

Weekly farmers' markets were held from July through September in Uniontown and Connellsville. A weekly log was used to monitor the number of people attending the markets, as well as the number of people purchasing fruits and vegetables. Attendance numbers ranged from 126 to 225 people for Uniontown and from 85 to 132 for Connellsville. The number of people observed purchasing fruits and vegetables ranged from 50 to 85 for Uniontown and from 70 to 100 for Connellsville. The log is included in this report for reference.

- **Develop and facilitate a marketing plan encouraging and promoting the access and consumption of locally grown fruits and vegetables**

Fay-Penn utilized multiple advertising and promotion methods when marketing the Uniontown and Connellsville Farmers' Markets in order to promote the access and consumption of specialty crops. These included:

- Weekly ads in three newspapers covering Fayette County and surrounding areas, i.e., Herald-Standard, The Daily Courier, and The Tribune Review.
- Weekly ads in "The Weekender", a weekly, independent magazine distributed throughout Fayette County.
- Radio ads on Froggy 94.9 radio station and WMBS 590 radio station (200 60 second spots)
- Yard signs placed on main roadways and streets leading to and from the location of each market.

- Banners displayed on buildings in Uniontown and Connellsville advertising the sale of specialty crops at each market.
- Weekly social media posts on Facebook and Twitter, which were shared on other pages and accounts.
- Flyers distributed at Fay-Penn events and at partner organization events.

As a result, numerous farmers and other vendors benefitted from the advertisement of the Uniontown and Connellsville Farmers' Markets. These vendors included eight farmers, three local wineries, two bakers, two crafters, one apiary, and one food hub, which sourced fruits and vegetables from ten regional farms and also sold value-added products made in their commercial kitchen.

**Work Plan Goal 2:**

- **Develop educational brochure with assistance from Highlands Hospital staff on the health benefits of eating locally grown fruits and vegetables.**

While the educational brochure was not developed due to time and budget constraints, education was performed. Fay-Penn partnered with the Penn State Cooperative Extension of Fayette County to support their efforts in conducting educational children's activities at both markets. The 4-H and Youth Development Extension Assistant provided a curriculum for, and carried out activities along with the assistance from, the East End Community Center (a local non-profit organization). The activities were held every week at the Uniontown Market and from August 1<sup>st</sup> through September 12<sup>th</sup> at the Connellsville Market. The focus of each activity was on specialty crops grown in Pennsylvania with an average number of 12 children participating per week.

- **Develop and implement survey on healthy eating and locally grown fruits and vegetables.**

A survey on healthy eating and locally grown fruits and vegetables was developed and given to consumers on three separate occasions at each market, totaling six separate instances the survey was implemented. A copy of the survey is included, as well as an analysis of the results.

- **Perform healthy cooking with locally grown fruits and vegetables demonstration**

Cooking demonstrations were held at three Uniontown Farmers' Markets utilizing local chefs who were selling hot, prepared food in conjunction with the Storey Square Summer Concert Series. Three chefs participated in cooking demonstrations utilizing produce from the farmer's markets.

**Work Plan Goal 3:**

- **Develop and implement a survey to be handed to farmers selling fruits and vegetables at**

**farmers markets and farm stands to identify amount of fruits and vegetables being sold monthly**

A survey was developed and presented to vendors for their participation. Due to time constraints and complaints from the vendors, the survey was not implemented. The vendors were unwilling to provide information regarding the volume of fruits and vegetables they offered nor how much were sold. In addition, the vendors were reluctant to commit to participate in every market due to numerous competing markets and the poor growing season.

**PERFORMANCE MEASURES (Expected vs. Actual):** What follows is a summary of the anticipated performance measurements as contained in the grant application:

**1. Average of 600 people weekly purchasing from the farmers selling specialty crops/locally grown fruits and vegetables at Fayette County farmers markets.**

In previous years, no formal system was in place to track the number of individuals attending the farmers' markets and/or purchasing fruits and vegetables. In order to establish a baseline, a weekly log was kept. Attendance numbers ranged from 126 to 225 people for Uniontown and 85 to 132 for Connellsville. The number of people observed purchasing fruits and vegetables ranged from 50 to 85 for Uniontown and 70 to 100 for Connellsville. The performance measure goal of 600 was not met due, in part, to the elimination of markets at other locations throughout the County.

**2. Collection of quantity data relative to specialty crop items sold.**

While a weekly log was developed and distributed, the vendors at the two farmers' markets were not willing to disclose this information.

**3. Conduct 6 healthy eating cooking demonstrations; survey 200 people about health eating and consumption of fresh fruits and vegetables; and development and distribution of 100 brochures on the health benefits of locally grown fruits and vegetables**

Three (3) healthy cooking demonstrations were conducted during farmers' markets and at least 200 people were surveyed about healthy eating and consumption of fresh fruits and vegetables.

Fay-Penn partnered with the Penn State Cooperative Extension of Fayette County to support their efforts in conducting educational children's activities at both markets. The activities were held every week at the Uniontown Market and from August 1<sup>st</sup> through September 12<sup>th</sup> at the Connellsville Market. The focus of each activity was on specialty crops grown in Pennsylvania with an average number of participants of 12 children per week.

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|                  | <p>The healthy eating educational brochures were not developed or distributed due to time and resource constraints.</p> <p><b>4. Conduct 3 surveys with local producers that sell at Fayette County farmers markets and 1 roadside market and evaluate the number of specialty crops theysell each week.</b></p> <p>This performance measure was not met due to the unwillingness of vendors and roadside market owners to share their sales information.</p> <p><b>Other Problems/Delays:</b> Fay-Penn underwent numerous changes, including a reorganization of its staff, a shift in priority programs, and a shift in where limited resources are allocated. As part of these changes, the Farmers’ Markets were eliminated in Brownsville, Masontown, and Scottdale. These were eliminated in part because of competition from larger, more established farmers’ markets located nearby. Connellsville and Uniontown, which are located in areas more accessible to a larger population of Fayette County, are more competitive and successful for local vendors. The Main Street Program in Uniontown, a major partner in the Uniontown Farmer’s Markets, was discontinued.</p> |
| Beneficiaries:   | <p>Hundreds of local residents purchased specialty crops at the local markets and a number of others (including children) participated in educational programs and demonstration.</p> <p>Local vendors also benefitted from the project including eight farmers, three local wineries, two bakers, two crafters, one apiary, and one food hub, which sourced fruits and vegetables from ten regional farms and also sold value-added products made in their commercial kitchen.</p> <p>Since representatives from the local municipalities and community organization’s partnered in the sponsorship of these Farmer’s Market events, those organizations benefitted from the advertisements and promotion provided by grant.</p>   |
| Lessons Learned: | <p>Overall, the primary objectives were met as more residents had access to, and were encouraged to purchase and consume locally grown fruits and vegetables. Through increased consumer traffic and sales, farmers learned what types of specialty crops were in demand that may encourage the production of more specialty crops for local consumption.</p> <p>Noteworthy findings include:</p> <ol style="list-style-type: none"> <li>1) Local vendors/farmers are unwilling to divulge information relative to their sales and profits;</li> <li>2) A significant amount of staff, administrative and financial resources were required to adequately manage such a project with little to no available funding or opportunity to generate income for self-sustainability. It is recommended that additional financial support and/or an elimination of match requirements should be available for organizations willing to undertake the task of marketing and promoting the production and consumption</li> </ol>   |

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|                   | <p>of agriculture and specialty crops. The cost of administering the project can be relatively high and unaffordable for the administering agency; and</p> <p>3) The elimination of the Local Economy Department was not a reflection of the failure of the Specialty Crops Grant project or the lack of need for agriculture support in Fayette County.</p>  |
| Contact Person:   | <p>Twila Kendall, Fay-Penn Grant &amp; Contract Compliance Coordinator<br/>724-437-7913<br/>twilak@faypenn.org</p>  |
|                   |   |
| <b>Project 10</b> | <b>Developing Ecologically-Based Tree Fruit IPM Programs That Conserve Managed &amp; Wild Pollinators</b>   |
| Project Summary:  | <p>To better understand the effects of pesticide applications on honey bees and other pollinators in fruit crops, we measured the field exposure of bees to pesticides in the nectar and pollen after field applications of various commonly used early season pesticides and those applied in the fall to control the Brown Marmorated Stink Bug (BMSB). We determined if the application timing of critical sprays for pests could be modified to retain control of the pest, but reduce the movement of pesticides into the nectar and pollen. To understand the chronic exposure of bee larvae feeding on contaminated pollen, we will use a short-ranged mason bee to bio monitor several grower orchards and measure the pesticide levels from pollen they have naturally collected. These realistic field exposure levels will be the starting point for future studies to integrate bee-safe pesticides and application timings into apple and other fruit IPM programs. An IPM standard for pollinator safety was developed for USDA-NRCS conservation programs.</p>   |
| Project Approach: | <p>Despite a general consensus that CCD is caused by multiple factors such as new diseases, parasites, nutrition, and the stress of interstate transportation, many bee ecologists and the media have concentrated their efforts to blame pesticides, especially the class of systemic insecticides known as the neonicotinoids. The systemic activity of neonicotinoids makes them of special concern for pollinators just as systemic organophosphate and carbamate insecticides (i.e. Carzol, Supracide, Cygon, Swat, Orthene, and Lannate) were before they were mostly eliminated by the FQPA re-registration process. Systemic pesticides are obviously nothing new for the tree fruit industry; indeed, many of our fungicides like Rally/Nova/Indar are very systemic, which is why they work. Systemic activity in a pesticide used to be considered desirable from an IPM perspective because it minimized the exposure of beneficial predators/parasitoids to the pesticide, but selectively controlled the pests feeding on the plant tissues. Those who wish to vilify the neonicotinoids need to understand that these were the ‘reduced risk’ pesticides of 10 years ago, and replaced the much more human-toxic organophosphate insecticides. Neonicotinoids are key components of resistance management programs in many crops including apple where we have organophosphate and pyrethroid resistant rosy apple aphid. They are also often the ‘soft/selective’ choice to promote IPM (e.g. safe to the predatory mite <i>T. pyri</i> and less harmful to woolly apple aphid parasitoids &amp; predators) and their elimination would require the use of non-IPM friendly</p> |

products such as pyrethroids or the few less human safe organophosphates and carbamates that are left. This is especially true for control of the invasive Brown Marmorated Stink Bug in Pennsylvania tree fruit where neonicotinoids are by far the least human and environmentally toxic pesticide options available and least disruptive of established IPM programs, especially those relying on biological control.

The systemic movement of all neonicotinoid insecticides into the nectar and pollen of a crop like apple is an unfortunate characteristic that needs to be better understood for each pesticide as some products are more systemic or bee-toxic than others. The systemic movement and toxicity of other new products touted as “bee-safe” by chemical companies (e.g. Closer, Sivanto & Centaur) need to be independently evaluated for bee safety as well. Mitigating IPM techniques such as modifying the timing of applications to minimize bee impacts while still controlling the key pest (i.e. moving a rosy apple spray at pink to ¼ inch green) or selecting the least bee-toxic material are relatively quick fixes to the problem of systemic bee activity that can be accomplished in a season or two. If we can accomplish this, we would look good to the public as being proactive in dealing with the problem and still maintaining the integrity of our IPM systems. Such bee-friendly standards dealing with sustainability issues are already being developed by distributors such as Whole Foods and Walmart. To date, however, these standards are being developed by environmental groups such as the Xerces Society or prominent ecologist/bee ecologists, but with little input by fruit growers or the IPM community. Including the producers and IPM researchers into the development of such standards, would help insure that these standards would be realistic enough to be implemented by growers without undue hardship. The existence of such pollinator pesticide standards for different crops would also be helpful in the marketing of fruit domestically with the GAP certification program and for export in countries where EuroGAP and PRIMUS are already beginning to incorporate best practice standards for pollinators.

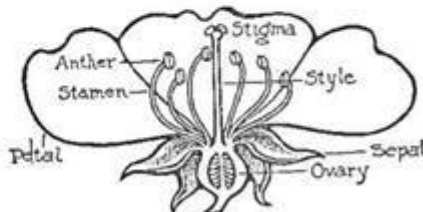
Pesticides are certainly one of the factors contributing to Colony Collapse Disorder (CCD). No one, however, has been able to identify pesticides as the main cause, despite numerous studies. Early reports of pesticides in pollen and nectar in honey bees were essentially surveys to see what they were being exposed to. Unfortunately, these studies focused on numbers of pesticides and rates of detection rather than if these numbers at a few parts per billion had any biological relevance. Recent advances in our analytical ability to detect pesticides have almost guaranteed that pesticides will show up at some level wherever the samples are taken. Many ecological studies, however, have used pesticides rates in studies that are much higher than could legally be used in a crop even under the worst-case scenarios of maximum seasonal rates and number of applications. Evaluations of residues in the nectar and pollen using normal fruit grower use patterns and rates of formulated pesticides are necessary to give realistic exposure levels per flower to a bee for its daily foraging of nectar and pollen. Chronic exposure levels can also be calculated knowing these levels for a lifetime of exposure if we know the number of flowers a female bee visit during a day and if we know the number of days a bee can forage. For the honey bee, calculating the daily amount of pollen and nectar consumed has been worked out for standardized EPA testing.

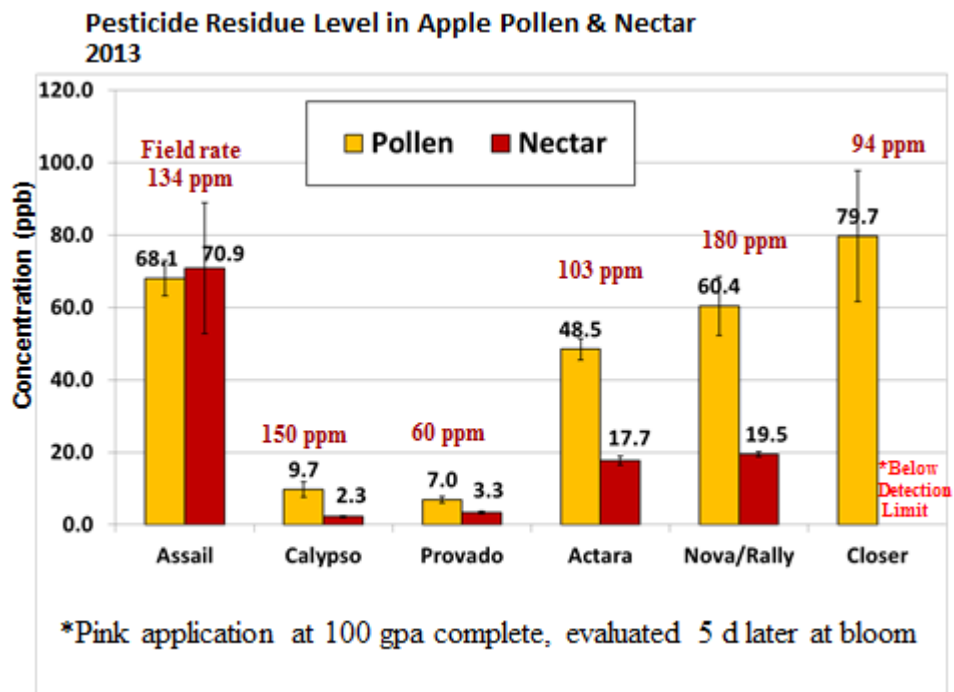
Goals and Outcomes Achieved:

*Realistic Field Data* from nectar and pollen taken from apple trees sprayed near harvest in the fall of 2013 for BMSB control and spring of 2014 for rosy apple aphid control at the half-inch green or pink stages using gas chromatograph mass spectrophotometry (GC Mass Spec) in the Mullin lab on campus show that, while most pesticides are applied at rates of 80-200 parts per million (ppm), what we can find in the flowers is 1,000 to 10,000 times lower at around 2-80 parts per billion (ppb) when a single foliar application is made at the pink stage and evaluated 5 days later at bloom when bees would realistically contact it (See data below).



- 6 treatments, replicated 5 times
- applied at pink
- 50 flowers/tree
  - Collected whole flowers before & after application
  - nectar in 1 microliter pipettes
  - pollen with eyebrow combs





These levels are all well below the No Observable Effect Limit (NOEL) for acute toxicity to honey bees as determined by EPA for registration for all compounds tested.

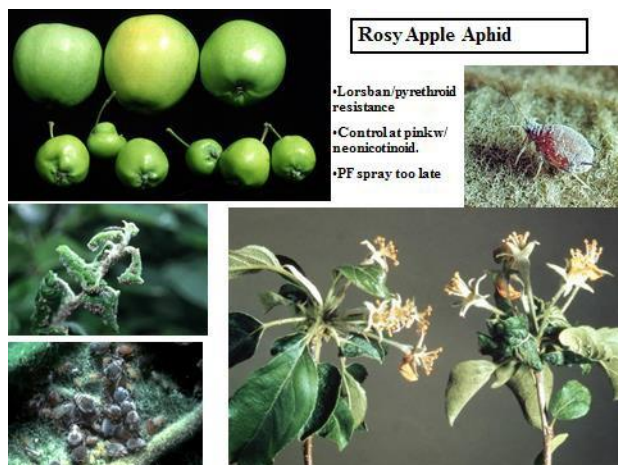
**BMSB Applications:** BMSB sprays are generally applied as multiple sprays at higher rates than those generally used in spring against rosy apple aphid, but are also used several months before apple bloom. Some of the products used such as Scorpion, Belay and Actara, however, are the most bee toxic and persistent products of their class, so it is possible they could show up during bloom of the following season. The following 5 treatments were applied for BMSB control in the fall of 2014 to single tree plots replicated 4 times. The treatments (applied at 7 day intervals between sprays based on their pre-harvest intervals or best timings – approximated dates) include: 1) Endigo (8/29), Leverage (9/5), Scorpion (9/12 & 9/19); 2) Scorpion (8/29 & 9/5); 3) Belay (9/12 & 9/19); 4) Closer (8/29 & 9/5); and the untreated check.

Nectar and pollen samples taken from trees in another orchard that had been sprayed with high rates and multiple applications of dinotefuron, clothianidin, and thiamethoxam in a manner recommended to fruit growers to control BMSB in the fall to protect fruit close to harvest showed no traces of these pesticides. Unlike research in other crops where the pesticides are applied in the soil as seed treatments, chemigation, soil drenches, or trunk injections and would be protected from UV degradation, foliar applications of neonicotinoids did not carry over the winter to be expressed in nectar or pollen of the same trees the following spring during bloom at levels that could be detected (>2 ppb). This is very encouraging in that while many of these BMSB sprays have been very disruptive to our biological agents of mites, aphids and other pests, these sprays do not seem to directly impact our pollinators.

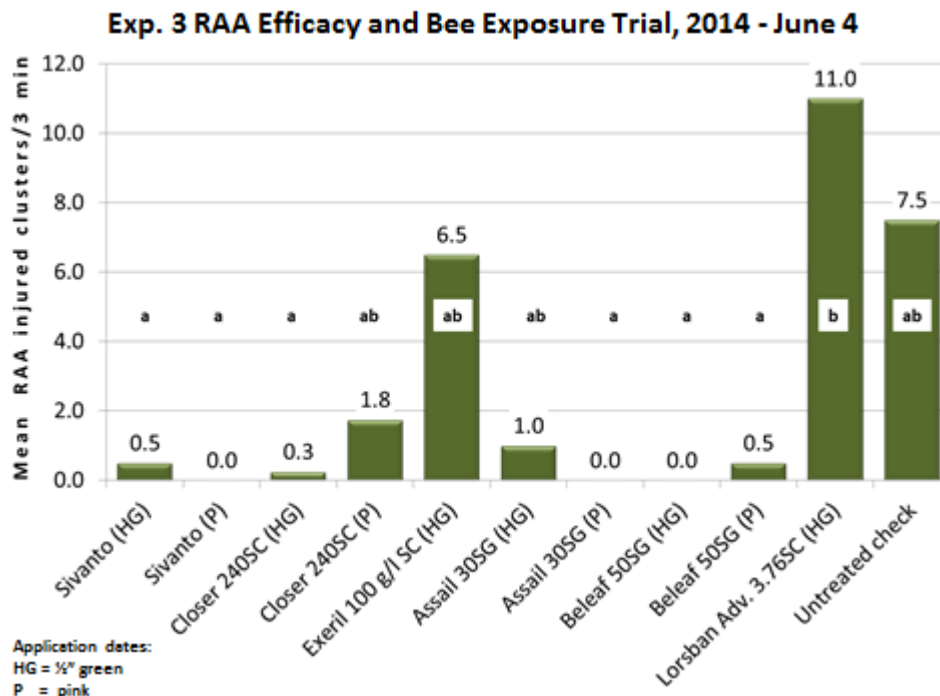
*Mitigating residues in nectar and pollen to pollinators while still controlling Rosy Apple Aphid (RAA)* – Neonicotinoids are key components of resistance management programs in many crops including apple where we have organophosphate and pyrethroid resistant RAA.



They are also often the ‘soft/selective’ choice to promote IPM (e.g. safe to the predatory mite *T. pyri* and less harmful to woolly apple aphid parasitoids & predators) and their elimination would require the use of non-IPM friendly products such as pyrethroids or the few less human safe organophosphates and carbamates that are left. Unfortunately, the damage from RAA occurs during bloom and results in stunted, pygmy fruit that are not marketable (See figure below). Applications made after bloom will not prevent this injury and the current recommendations for control were to spray only 5-7 days before bloom to improve RAA control.

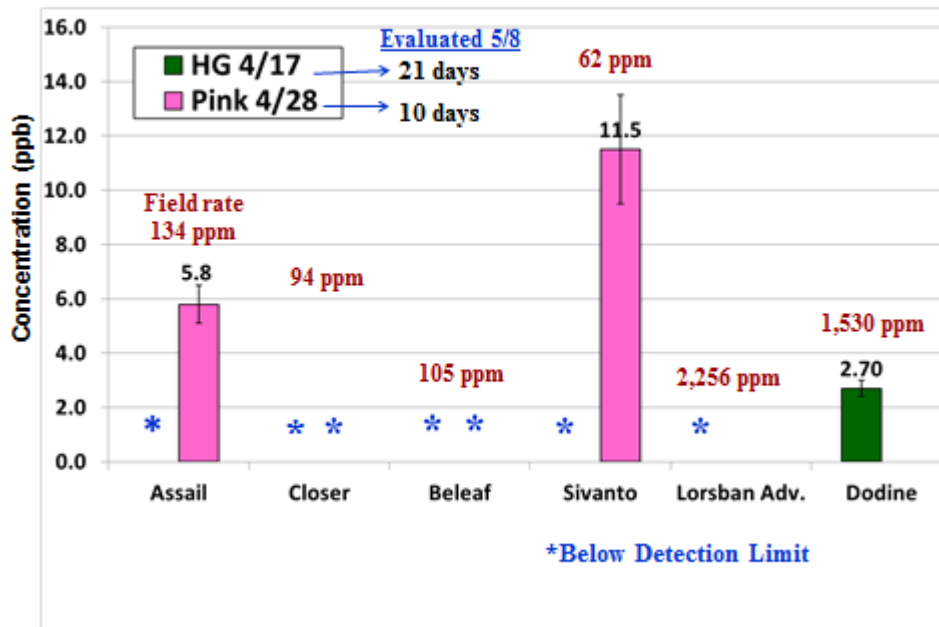


We decided to re-examine the control timing for RAA to include an earlier timing for efficacy and to determine whether it would minimize pesticide residues present in the nectar and pollen. The results in the figure below indicate that moving the RAA control applications from the pink stage to an eleven day earlier timing at the half inch green stage gave comparable control to the traditional pink timing



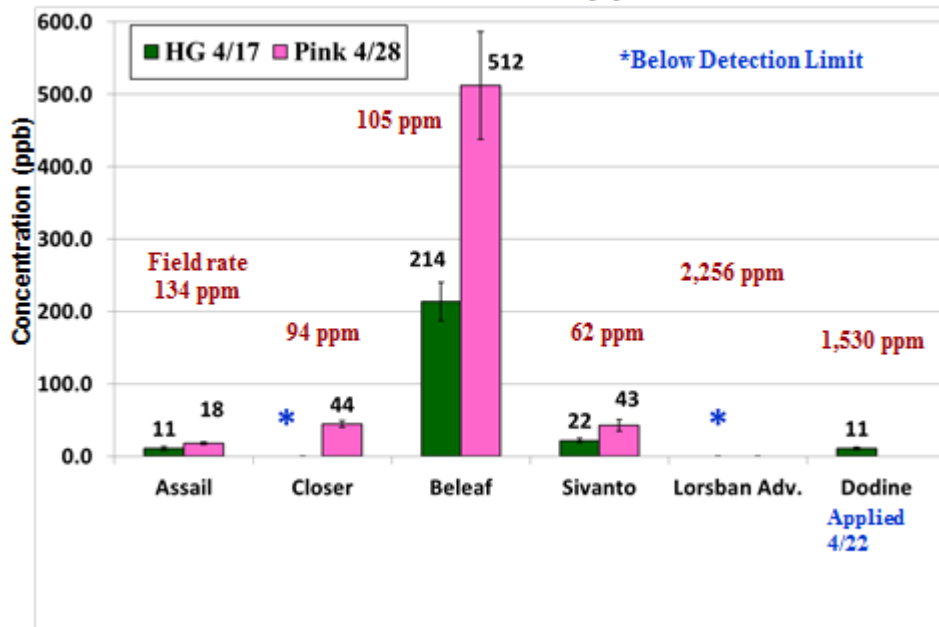
Pesticide residues in the nectar indicated that two of the compounds, Closer (sulfoxaflor) and Beleaf (flonicamid) did not move into the nectar at detectable levels from either timing, but that the neonicotinoid insecticides Assail (acetimid) and Sivanto (flubendazole) were both reduced below detection with the earlier timing. Lorsban (chlorpyrifos) was not effective on in controlling RAA due to resistance and the fungicide, dodine was found in the nectar.

### Pesticide Residue Level in Apple Nectar 2014



Closer and Beleaf were both found in the pollen, but the levels from the earlier half inch green timing, reduced Beleaf levels by half and reduced Closer levels below detection limits (see figure below). Similarly Assail and Sivanto levels were reduced in the pollen by about half in the earlier application timing.

### Pesticide Residue Level in Apple Pollen 2014



Use of the JOB to Bio monitor Levels of Pesticides in Apple Orchards:

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|                                       | <p>We have shown JOB to forage for only 100 yards or so from the nests and that when placed in or near an apple orchard that at least 90% of its pollen is from apple. Similar studies have been tried with honey bees, but because they forage for several miles and often prefer plants with more sugary nectar, often less than 20% of the pollen of their hives in apple orchards contains pollen. This means honey bees are a poor tool for monitoring the pesticide exposures to bees of all types for most crops and especially for specialty crops which are usually grown and managed at a much smaller spatial scale. Data on pesticide levels in apple pollen collected by bees will give us realistic pesticide levels in pollen being consumed by JOB larvae during the summer and would be the starting point for future studies looking at chronic long-term mortality from pesticides, and more subtle sublethal effects on development and reproduction which could affect future generations of bees. Again, this methodology is easily transferable to other species of managed bees such as bumble bees, blue orchard bees, and leafcutter bees for various specialty crops. Pollen collected in May 2015 from nests placed adjacent to 6 commercial apple orchards were analyzed as 3 g samples at the USDA-Gastonia, NC lab. The nest at one site was accidentally destroyed by orchard equipment, but the pollen collected from the other sites have been analyzed and in general closely reflect the spray programs of the orchards in which they were placed. The analyses from the final samples have not yet been completed and all need to be correlated with the grower spray records which have just been received post-harvest. This data and the nectar/pollen sampling are part of a MS student in entomology who is compiling this data for her thesis. In general, however, the levels in these pollen balls were lower than that found in the combed-out pollen taken during bloom, indicating forth degradation of residues. Additionally, Osmia larvae that had feed on the pollen collected by their mother in these orchards, had no detectable levels. This may mean further metabolic breakdown occurs during feeding. Determine what effects these pesticide levels through chronic ingestion have on Osmia development are the next step in understanding long term effects on pollinators.</p> |
| <p>Beneficiaries/Lessons Learned:</p> | <p>Transfer of Information to the Growers, Public &amp; Scientific Communities</p> <p>This information has been incorporated into the Penn State Tree Fruit Production Guide 2016-17 with changes to the bee toxicity tables and the recommendations for RAA control now recommending the earlier half-inch green stage timing to minimize residues in the nectar and pollen to fruit growers of the Mid-Atlantic region. The only neonicotinoid insecticides currently recommended are the much more bee safe products of Assail and Sivanto. Pesticide impacts on pollinators have also been communicated directly to fruit growers through articles in the monthly on-line Fruit Times website by Penn State with articles such as: <a href="http://extension.psu.edu/plants/tree-fruit/news/2014/pollinators-and-pesticide-sprays-during-bloom-in-fruit-plantings">http://extension.psu.edu/plants/tree-fruit/news/2014/pollinators-and-pesticide-sprays-during-bloom-in-fruit-plantings</a>, <a href="http://extension.psu.edu/plants/tree-fruit/news/2013/the-role-of-pollen-bees-in-fruit-tree-pollination-and-some-new-cautions-on-pesticide-use">http://extension.psu.edu/plants/tree-fruit/news/2013/the-role-of-pollen-bees-in-fruit-tree-pollination-and-some-new-cautions-on-pesticide-use</a>, and with links to a radio interview by National Public Radio at: <a href="http://extension.psu.edu/plants/tree-fruit/news/2015/diversification-in-bee-pollination">http://extension.psu.edu/plants/tree-fruit/news/2015/diversification-in-bee-pollination</a>.</p> <p>In conjunction with the Xerces Society for Invertebrate Conservation, we have incorporated pesticide recommendations to mitigate pollinator impacts in: Preventing or Mitigating Potential Negative Impacts of Pesticides on Pollinators Using Integrated Pest Management</p>   |

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|                   | <p>and Other Conservation Practices in the USDA Agronomy Tech Note No. 9 found at: <a href="http://www.xerces.org/wp-content/uploads/2014/04/NRCS_Pesticide_Risk_Reduction_TechNote.pdf">http://www.xerces.org/wp-content/uploads/2014/04/NRCS_Pesticide_Risk_Reduction_TechNote.pdf</a>. This is intended as a guide and pollinator standard for USDA-NRCS and other government agencies. Also with Xerces and Cornell University, we have updated the pesticide tables in the Northeast IPM publications “Wild Pollinators of Eastern Apple Orchards and How to Conserve Them: 2<sup>nd</sup> edition at: <a href="http://extension.psu.edu/pests/ipm/native-pollinators/extension-and-outreach/wild-pollinators-of-eastern-apple-orchards-and-how-to-conserve-them/view">http://extension.psu.edu/pests/ipm/native-pollinators/extension-and-outreach/wild-pollinators-of-eastern-apple-orchards-and-how-to-conserve-them/view</a>.</p> <p>To the scientific community, we have published a peer-reviewed article entitled: Integrated Pest and Pollinator Management: Adding a New Dimension to an Accepted Paradigm. - <a href="https://www.researchgate.net/publication/277960363_Integrated_Pest_and_Pollinator_Management_Adding_a_New_Dimension_To_An_Accepted_Paradigm">https://www.researchgate.net/publication/277960363_Integrated_Pest_and_Pollinator_Management_Adding_a_New_Dimension_To_An_Accepted_Paradigm</a> which offers modifications to the tried and true IPM paradigm to offer solutions to mitigate pesticide impacts on pollinators rather than calling for blanket bans of pesticides such as the neonicotinoids. Numerous extension presentations of this information have been made directly deliver information to fruit growers through winter meetings such as the Hershey Fruit and Vegetable Convention, the Ontario Fruit and Vegetable Convention and the Illinois Fruit and Vegetable Convention.</p> |
| Contact Person:   | <p>David Biddinger, Ph.D.<br/>Associate Professor, Tree Fruit Research Entomology,<br/>Penn State University Fruit Research &amp; Extension Center<br/>Biglerville, PA 17307<br/><a href="mailto:djb134@psu.edu">djb134@psu.edu</a> 717-261-7184</p>   |
| <b>Project 11</b> | <b>Small Apples, Big Impact: Connecting Cosmetically Imperfect Specialty Crops to Farm to School Programs</b>  |
| Project Summary:  | <p>Pennsylvania specialty crop growers and public school districts in the commonwealth innovatively explored the use of cosmetically imperfect PA-grown fruits and vegetables in school meals. This pilot program was a partnership between The Food Trust, Upper Moreland School District, and several Pennsylvania farmers, as they explored and evaluated the opportunity to reduce on-farm food waste, increase access to healthy PA specialty crops for school-aged children, and create secondary markets for otherwise-wasted healthy, affordable wholesale specialty crops. The intended benefits included: enhancement of Upper Moreland School District’s robust farm to school program as benefits from new farmer relationships, cost-effective purchasing strategies, and the capacity to menu more locally grown produce, such as apples, broccoli, and sweet potatoes, on school lunch menus; a new secondary market for cosmetically imperfect fruits and vegetables for PA specialty crop growers as a strategy to recoup costs associated with input resources, and the promotion of their crops to the next generation of food buyers; and a model that may be replicated elsewhere in the commonwealth to reduce food waste, enhance school meals, and support Pennsylvania’s specialty crop growers.</p>  |

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|                                 | <p>In the U.S., ~40% of food produced, worth \$165 billion, goes uneaten at a time when 49 million people live in food-insecure households. This wasted food represents post-consumer waste in the form of foods purchased and spoiled in households and foods prepared for eating and discarded, as well as foods that never successfully entered the wholesale and retail markets, and those foods never harvested in the field. A high-level, multi-pronged approach is necessary to mitigate this complex problem, and should include emerging farm to school purchasing models as part of a greater solution to reducing food waste in the nation.</p> <p>Meanwhile, Pennsylvania growers produce a wide variety of specialty crops, from apples to zucchini. These farmers serve diverse markets across the state, including wholesalers, retailers, institutions including public K-12 schools, and the hospitality sector. However, the most recent Census of Agriculture has revealed Pennsylvania lost nearly 4,000 farms over a recent five-year period and that the state's total farm acreage dropped by about 100,000. Comprised of mostly small to mid-sized farms, Pennsylvania's agricultural economy continues to need increased consumer support across agricultural products, including specialty crops.</p> <p>While obesity trends in Pennsylvania are beginning to reverse course, adolescents and children in the commonwealth still experience overweight and obesity at rates of approximately 15%, with the youngest children in the state (ages 2-5) experience an obesity rate of 12%. Additionally, fruit and vegetable consumption rates among school-aged children in Pennsylvania typically are well below the daily recommended "My Plate," servings, with children consuming less than 3 servings of fruits and vegetable 85% of the time. Finally, school food service operations have faced increasing challenges over the past several years in two related ways: 1) The "new" USDA school meal pattern's requirement of a fruit or vegetable component in school lunches and (2) the overall trend of increasing prices of fruits and vegetables. As food service directors seek solutions in terms of providing meals that include healthy, delicious school lunches, their ability to procure specialty crops at a manageable cost has become increasingly important.</p> <p>As Pennsylvania seeks solutions to support its agricultural economy, especially those farmers growing healthy, school-friendly specialty crops, and as the state seeks to lower overweight and obesity rates while increasing consumption of fruits and vegetables among schoolchildren in a cost-effective manner, we piloted a project that addresses both of these needs in the context of helping to ameliorate our nation's food-waste problem.</p> |
| <p><b>Project Approach:</b></p> | <p>From October 2014 through September 2016, The Food Trust worked collaboratively with Upper Moreland School District and Pennsylvania growers and distributors to understand how cosmetically imperfect specialty crops could fit into Upper Moreland's school meal program and how the sale of such products to schools could fit into the business operations of the Pennsylvania agricultural community. Through research, a pilot phase, and implementation phase, The Food Trust explored and evaluated these opportunities and has provided recommendations and best practices to project partners and other farm to school stakeholders in Pennsylvania.</p>  |

The partners involved in this project have accomplished the goal of increasing purchases of cosmetically imperfect Pennsylvania specialty crops by Upper Moreland School District. The conclusion is that cosmetically imperfect products do have a place in school meal programs and do represent a viable business opportunity for growers. The project partners recommend without hesitation that schools and farmers and distributors in other areas seek out these types of business relationships.

**Project Activity: Research and Crop Identification**

Child nutrition programs across the country have evolved significantly since the passage of the Healthy Hunger Free Kids Act of 2010. As school food authorities began to change operations and menus to meet new nutritional guidelines, a related need emerged: further guidance and training from USDA and state agencies around proper procurement principles and procedures.

The USDA Farm to School team began publishing resources about procurement in March 2014 and The Pennsylvania Department of Education offered its first training on this topic in March 2016. As The Food Trust facilitated business relationships between Upper Moreland School District and local growers, the organization recognized the need for a solid understanding of procurement principles was necessary; much research was done on this topic. Project Coordinator Kelsey Porter carefully read through USDA Farm to School’s “Procuring Local Foods for Child Nutrition Programs” guide, participated in twelve USDA webinars on the topic, and attended two in-person USDA-led training sessions. Additionally, Kelsey and the Upper Moreland Food Service Director participated in the Pennsylvania Department of Education’s webinar training in March 2016 and in-person training in August 2016. Because of The Food Trust’s and Upper Moreland’s commitment to understanding these principles, this project was ahead of the curve in its compliance with these regulations.

Additional research that was done included the compiling of price lists from Upper Moreland and local growers and suppliers, menu review, and outreach to around 30 local growers, extension agents and other stakeholders from the Pennsylvania agriculture sector. This research informed which specialty crops would be targeted for incorporation.

**Project Activity: Collaboration with Upper Moreland School District**

Between the time the proposal was written and the project start date, Upper Moreland experienced a significant staffing change. Food Service Director Cynthia Van Druff retired and Melissa Froehlich assumed her role. Such a change could have greatly affected the course of this work, but Melissa proved to be a committed and enthusiastic partner from the outset. Collaboration with Upper Moreland was key to this project’s success. Kelsey and Melissa met in person and over the phone dozens of times over the course of the project period.

Main points of collaboration included Upper Moreland’s sharing of records, menus, and price lists with The Food Trust; The Food Trust’s sharing of farmer outreach progress with Upper Moreland; the coordination of joint calls with potential vendors; joint tracking of new sales and student acceptance; coordination of events, promotions, new initiatives, and staff

trainings; and long term planning. Because Upper Moreland openly shared quantitative and qualitative information with The Food Trust, a solid understanding of the viability of cosmetically imperfect products in school meal programs was achieved. On the whole, Melissa has described Upper Moreland’s involvement as a “fantastic experience” for herself, the school district, and more than 3,000 students and their families that are part of Upper Moreland’s school community.

**Project Activity: Collaboration with Pennsylvania Farmers**

The Food Trust conducted outreach to more than 30 stakeholders in the Southeastern PA agricultural community, including individual growers, distributors, extension agents from surrounding counties, and other farm to school and agriculture organizations. The Food Trust looked beyond Montgomery County for additional opportunities for Upper Moreland. Ultimately, the key partners that emerged were Frecon Farms; an orchard located in Boyertown, PA; and Lancaster Farm Fresh Cooperative (LFFC); a nonprofit organic farmer’s cooperative of over 100 families based in Lancaster, PA. These partners collaborated with The Food Trust and formed a business relationship with Upper Moreland School District. Lancaster Farm Fresh Cooperative provided Upper Moreland with cosmetically imperfect sweet potatoes and Frecon Farms provided Upper Moreland with apples.

Points of collaboration include joint phone calls with Upper Moreland School District; discussions of feasibility, viability, and benefits of selling cosmetically imperfect products to schools; sharing of price lists and records; coordination of promotions and special events, including a farmer assembly for UMSD elementary students and the site visits described below.

**Project Activity: School Food Service Farm Tour & Orchard Site Visit**

Upper Moreland and Food Trust staff participated in a farm and warehouse tour conducted by LFFC Executive Director Casey Spacht in May 2015. The group toured LFFC facilities and then visited two vegetable farms to introduce the UMSD staff to specialty crop growers, and give them a tangible sense of what small, family-owned farms looked like and how they operated in the region. This was a valuable time for both UMSD and LFFC to learn about each other’s operations and to discuss potential arrangements. During this time, UMSD and LFFC solidified a communications and purchasing plan.

Additionally, Project Coordinator Kelsey Porter visited Frecon Farms in July 2016 to tour the farm and discuss lessons learned and the feasibility of expanding this model to other schools. Steve offered information and insight into the ways in which working with schools has benefitted his business. He has committed to partnering with schools and collaborating with statewide stakeholders going forward.

**Project Activity: Minneapolis Research Visit**

The Food Trust served as the Mid-Atlantic Regional Lead Agency for the National Farm to School Network (NFSN) during this project period, connecting the agency to farm to school practitioners across the country and providing networking opportunities. Minneapolis Public



Schools (MPS) is an active member of NFSN and a national leader when it comes to incorporating local products, including cosmetically imperfect produce into school meal programs. In order to truly get a sense of how a large, urban district like MPS is able to work so closely with local growers, The Food Trust arranged a research trip in July 2015. The trip included two full days with MPS staff, three farm visits, and a meeting with MPS’s distributor. Key takeaways included the importance of streamlining paperwork and planning ahead in the form of forward contracting. This trip informed the conclusions and recommendations of this project which are further outlined in the “Lessons Learned” section of this report.

**Project Activity: Development of Promotion Materials for Upper Moreland School District**

The Food Trust worked with Upper Moreland, Frecon Farms, and LFFC to provide promotional materials that would highlight the PA specialty crops featured in the meal program. Point of sale signage with LFFC and Frecon logos was developed. Aesthetically pleasing woven baskets were purchased to display Frecon Farm’s apples and salad bar clings were purchased to highlight the local vegetables available. Student fact sheets and handouts were produced, such as one-pagers with nutrition facts. Additionally, The Food Trust worked with Upper Moreland and Northfound, a graphic design firm, to develop a menu template that featured PA specialty crops via a banner at the top of the page.

**Project Activity: School Food Service Trainings & Events**

The Food Trust provided one-on-one technical assistance to Melissa over the course of the two years, especially around procurement principles and supplier identification, as described above. The Food Trust facilitated one-on-one technical assistance for Melissa from USDA, connecting Tegan Hagy, Senior Program Specialist and Melissa over the phone for individualized TA and to establish a sustainable future relationship.

Additionally, The Food Trust provided trainings for the larger food service staff in 2016. In spring 2016, The Food Trust facilitated a discussion and led a brief training for around 12 high school nutrition staff. In August 2016, The Food Trust was able to execute a training for all food service staff (about 25 people) during set-aside professional development. This training session covered items such as what farm to school is and why it’s important, how Upper Moreland has been engaged in farm to school, and how the school food service staff can promote cosmetically imperfect PA specialty crops to students at their schools.

A final note on this project activity is that The Food Trust also had an exhibit table at this year’s School Nutrition Association of Pennsylvania’s (SNA-PA) Annual Conference. SNA-PA is a statewide network that has 2,300 school nutrition professionals as members. The Food Trust went to the event to promote farm to school and encourage school food service directors to incorporate PA specialty crops into their school meal programs. Melissa is currently serving a term as President of the SNA-PA board and is a key organizer of the 2017 SNA-PA gathering. She is committed to working with The Food Trust on incorporating more farm to school elements into SNA-PA events and resources.




**Project Activity: Pilot Phase for Implementation**

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|                                     | <p>The 2014-2015 school year served as a pilot phase for implementation of incorporating cosmetically imperfect specialty crops in Upper Moreland’s school meals. During this time, Frecon Farms sent a sample case of cosmetically imperfect apples (eighty pounds) along with an order of Number 1 apples. This was the first time a cosmetically imperfect product of any kind was served. It was considered a definite success in terms of student acceptance and consumption.</p> <p><b>Project Activity: Program Implementation</b></p> <p>During the 2015-2016 school year, Upper Moreland purchased cosmetically imperfect produce as part of regular school food service operations. Because cosmetically imperfect apples were successful during the pilot phase, the district was confident in serving these apples. Frecon Farm’s cosmetically imperfect apples were served every day of the school year while they were available, September through January. The apples have also been served every day so far in this school year and will be for years to come.</p> <p>Using cosmetically imperfect vegetables presents more of a challenge than the apples did, in that preparation of vegetables is necessary whereas apples can be served whole. That said, Upper Moreland tested different cosmetically imperfect vegetables in their kitchens in the spring of 2016. With the support of The Food Trust, the district purchased, prepared, and taste tested 160 pounds of sweet potatoes at the high school. Sweet potato and black bean salad with a cilantro lime vinaigrette was well liked by students; the majority of students who tried the salad liked it. Many had never tried sweet potatoes before. Subsequently, the staff served this salad again and also served simple roasted sweet potatoes.</p> <p>As part of Upper Moreland’s overall farm to school program, Melissa and her staff completely renovated the district’s school garden space. Upper Moreland has used this garden as an education experience and way to get students excited about Pennsylvania agriculture. The garden has also provided an avenue for parent engagement, as Melissa is developing a parent volunteer system. This spring, the food service staff prepared and taste tested garden grown kale chips at the middle school—cosmetically imperfect kale leaves were included in this. This was a point of education for the students. Student acceptance of the kale chips was high.</p> <p>Upper Moreland will undoubtedly continue to purchase cosmetically imperfect apples as part of regular food service operations. The district will also continue to look at ways to incorporate fresh, local vegetables into operations. The sweet potato salad and kale chips were too labor intensive for the staff to produce on a regular basis, but there are other items that may require less preparation, such as items for the salad bar.</p> |
| <p>Goals and Outcomes Achieved:</p> | <p>Goal 1: Increased purchasing and serving of PA specialty crops in UMSD.</p> <ul style="list-style-type: none"> <li>During the time of this project, UMSD purchased 370 cases or about 14,800 pounds of cosmetically imperfect apples. These apples make up around 33% of all UMSD fresh fruit purchases, local and otherwise. The cost savings of purchasing cosmetically imperfect apples in place of Number 1s is nearly 50%.</li> <li>UMSD also purchased 160 pounds of cosmetically imperfect sweet potatoes. Using</li> </ul>   |

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|                | <p>cosmetically imperfect sweet potatoes in place of Number 1 sweet potatoes was cost neutral in terms of price. However, the labor required to process the fresh, whole sweet potatoes was too extensive to make this feel sustainable for the district.</p> <ul style="list-style-type: none"> <li>On the whole, UMSD far exceeded the goal of increasing purchasing and serving of PA specialty crops from 0-5% of all local produce purchased, as cosmetically imperfect apples now make up 33% of all fresh fruit purchases, saving the district thousands of dollars.</li> </ul> <p>Goal 2: Develop a successful bid/RFP for cosmetically imperfect PA specialty crops.</p> <ul style="list-style-type: none"> <li>Additional guidance around procurement principles from USDA and PDE changed this goal. Pennsylvania has a small purchase threshold of \$150,000, which means a formal procurement process requiring an RFP is not necessary unless the purchase amount exceeds \$150,000. For small and medium sized districts, produce purchases may not exceed this amount. In those cases and in the case of UMSD, a more informal process can be used. Melissa used this process in purchasing cosmetically imperfect products.</li> </ul> <p>Goal 3: Evaluate farmer and/or distributor impact of harvesting, packing, and selling of cosmetically imperfect foods.</p> <ul style="list-style-type: none"> <li>Frecon Farms typically sells seconds' apples to a local cidery and nets around \$5.20 per box. When selling seconds' apples to schools, however, the net is \$9.00 per box. Therefore, it is approximately 43% more profitable for Frecon Farms (and potentially other Pennsylvania orchards) to sell seconds' apples to schools rather than cideries.</li> </ul> <p>The target goal for this project was increase the types of quantities of specialty crops sold to the school district from zero to 1-2 varieties and at least 200 pounds of each type. Two varieties of cosmetically imperfect products were incorporated into UMSD's meal program. In the case of sweet potatoes, the weight fell 40 pounds short of the goal due to unsustainable labor costs associated with the product. In the case of apples, the project far exceeded the goal by thousands of pounds</p> |
| Beneficiaries: | <p>Benefits of the project for Upper Moreland School District's food service department include technical assistance for UMSD managerial staff, engagement and education for food service workers, and cost savings for the district. Upper Moreland Food Service Director Melissa Froehlich received many hours of technical assistance on procurement principles, supplier identification, gardening, and promotional strategies. Twenty-five food services workers also received their first training on incorporating and promoting PA specialty crops into the meal program. Additionally, the district saved an estimated \$5,200 on apples while supporting a local farm.</p> <p>Frecon Farms benefitted from this project in the form of increased sales and strengthened relationships. Selling cosmetically imperfect apples to schools was 42% more profitable for Frecon Farms than selling to a cidery. Additionally, Frecon Farms has strengthened its reputation and brand, particularly among the food service directors in Upper Moreland's buying group. The farm added Great Valley School District as a client this fall and continues to build relationships with schools in Southeastern PA.</p> <p>Upper Moreland's 3,025 students were also key beneficiaries of this work. During these two</p>  |

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|                         | <p>years, students experienced increased exposure to PA specialty crops in the form of promotional materials, special events, cafeteria offerings, and garden experiences. The 650 youngest learners at the Upper Moreland Primary School had a farmer come to their school for the first time to talk to them about PA specialty crops.</p> <p>This was a project that benefitted all involved and has the potential to benefit the state further as other districts and growers adopt this model.</p>   |
| <p>Lessons Learned:</p> | <p>Several key needs emerged over the course of this project. It is clear that continued guidance around procurement principles from government entities is necessary. Schools need to have vetted and established general procurement principles in place before they can feel empowered to think about buying local. Our recommendation regarding procurement principles for PA schools wishing to buy local is to start with informal procurement and consider crafting forward contracts. A forward contract is an agreement made between a school district and grower in advance of the time of sale. For example, Minneapolis Public Schools and Open Hands Farm have a forward contract stating that Open Hands Farm will provide the district with 27,000 pounds of carrots barring any unforeseen growing barriers. A forward contract allows both parties to plan ahead and streamline paperwork.</p> <p>Additionally, increased funding and infrastructure is needed to ensure schools have the ability to freshly prepare and scratch cook menu items rather than relying on heat and serve options. For example, fresh preparation of sweet potatoes at Upper Moreland School District was too labor intensive for staff—this was not an instance where local whole, fresh sweet potatoes were substituted for not-local whole, fresh sweet potatoes; and ultimately substituting whole, fresh PA sweet potatoes for canned, chopped sweet potatoes proved too big a leap for the staff.</p> <p>There is also a need for a streamlined mechanism to connect PA growers and food service directors. An online map or directory of farmers interested in selling to schools and schools interested in buying local, such as the website created by the Alabama Department of Agriculture, would be invaluable.</p> <p>These needs aside, The Food Trust’s main takeaway from this work is that incorporating cosmetically imperfect products into school meals is favorable both to districts and farmers. This is a way for PA schools to procure local, high quality items at an affordable price and for growers to find a viable and potentially more profitable wholesale market for their cosmetically imperfect products.</p> <p>Upper Moreland School District and Frecon Farms will continue their relationship into the future. Says Melissa: “This entire program was a fantastic experience. I will continue to search for different farms that will offer cosmetically imperfect fruits and vegetables to my program. I hope to continue the relationships I have built with our current local farms and continue to purchasing local and cosmetically imperfect produce when available. It is a huge cost savings and the yield is beautiful product.”</p> <p>Purchasing PA specialty crops has become an integrated part of Upper Moreland School</p> |

Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

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|                         | District's food service program. As Melissa begins her year as President of the Board of SNA-PA and as The Food Trust continues to build momentum for farm to school on the state level, other school districts, growers, and communities will be encouraged to implement robust farm to school programming and practices of this type to the benefit of students across the commonwealth. |
| Contact Person:         | Name the Contact Person for the Project: Deborah Bentzel, Associate Director, The Food Trust<br>Telephone Number: 215-575-0444 x 7189<br>Email Address: <a href="mailto:dbentzel@thefoodtrust.org">dbentzel@thefoodtrust.org</a>   |
| Additional Information: |  <p>Cosmetically imperfect apples from Frecon Farms that were served to UMSD students.</p>                                       |

Lancaster Farm Fresh Cooperative member farm visited during the food service farm tour (left), sweet potato taste test table (right), and new menu template for UMSD created by Northfound (below).



## Project 12

## Increasing the Food Safety Practices among the Specialty Crop Producers

### Project Summary:

The initial purpose of this project was to provide information directly to specialty crop producers through a variety of direct outreach events; including information on USDA GAP/GHP, MGAP, Harmonized Audits, and the FDA Food Safety and Modernization Act (FSMA)'s Produce Rule. Many specialty crop producers lack the resources needed to evaluate their agricultural practices on their farms, and to determine if improvements could be made to increase food safety. Secondly, additional training was to be provided to on-staff fruit and vegetable inspectors to keep their knowledge of food safety, USDA GAP/GHP requirements, and FSMA up-to-date and current. There was a third goal of creating videos of these events and providing them on-line, but this part of the project was removed due to projected changes in regulations that would put any videos produced during this time quickly out of date.

Provision of these programs was vital to growers throughout the state due to the increasing pressure these growers are feeling from both their customers, who are demanding verification of the growers' food safety practices (i.e. 3<sup>rd</sup> Party audits). Face-to-face informative meetings with growers would provide information on the requirements and costs of audits; and mock audits provided real-time experience with the audit process. Also, the looming deadlines for compliance with the FSMA Produce Rule made it necessary to continue outreach efforts to growers to help them learn if their operations would be covered by the Rule and what they need to do if so. Continuing education of on-staff fruit and vegetables inspectors is also key so that they are providing the most up-to-date information possible. This project ultimately helps the Pennsylvania Department of Agriculture continue to promote awareness of food safety issues and help farmers improve on-farm food safety practices. This will lead to a safer

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|                   | <p>food supply for everyone.</p> <p>This project built on the successes of the 2013-2015 Specialty Crop Grant “Outreach to Partner with Specialty Crop Buyers on USDA’s GAP/GHP Auditing Program and Sharing Information with their Specialty Crop Producers”. Following the completion of this project, and despite its success, it was realized that much more need to be done. Many more growers needed to be reached and more education done, hence the application for the 2014-2017 grant.</p>  |
| Project Approach: | <p>A total of seventeen (17) outreach events, which included both informational session and mock audit events were held over the course of the three years over which this grant was extended. These outreaches were held in five different geographical regions of the state in order to physically reach as many audiences as possible. A particularly unique outreach happened during 2017 – Farm to School events – where information about fruit and vegetable programs were relayed in a manner that also taught school youth, their teachers, and coordinators of school summer feeding programs the connection between farms and the foods they eat. Plain Sect farmers were also a target audience of this project throughout the course of its run. Penn State Cooperative Extension partnered with PDA in advertising and coordinating several of the events. Events were held in eleven counties in the southwest, central, south central, east central and southeast regions of the state.</p> <p>Seven (7) mock audits with an average of 14 attendees each were held. One event had low attendance due to another grower event happening the same night. At least two on staff fruit and vegetable inspectors attended and presented at the events. Attendees appreciated that these events were held in areas local to them, rather than requiring them to drive to distant locations. Being able to see practices and procedures demonstrated on site was extremely helpful to these growers. Many growers still had a level of discomfort and hesitancy about becoming involved in the GAP/GHP process. Being able to meet and talk to the actual auditors helped them become more comfortable and more open to having their operations audited. All the participants were very interested in the information. Along with real-time demonstration, participants were given packets that included the guidelines and costs of GAP/GHP and Harmonized audits. Penn State Extension helped organize several of these events and also provided information. Many of the farmers expressed that since they now understood that much of what they already do is applicable to the auditing process, it won’t be as difficult as they imagined, and having the audit performed will open more doors to them for their product to be sold. Information about the FSMA Produce Rule was also shared at all these mock audit events, informing growers how the GAP/GHP process coincides with and will help them reach compliance with the FSMA Produce Rule.</p> <p>A second form of targeted outreach was to volume food buyers. One event was a meeting at the Giant Eagle in Cranberry Township, Allegheny County. Local farmers, Giant Eagle produce buyers, and Giant Eagle food safety personnel (a total of 25) were in attendance. Giant Eagle requires a 3<sup>rd</sup> party food safety audit from all their suppliers and this outreach helped both Giant Eagle, and their suppliers learn how the GAP/GHP process works and how it can fit with Giant Eagle’s requirements. Information about the FSMA Produce Rule was also shared at this</p> |



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|                              | <p>event.</p> <p>Targeting a different type of volume food buyer were five(5) outreach events called “Farm to School: Making the Connection” events. Although each of these events took slightly different forms, they all were based on the collaboration between the Pennsylvania Department of Agriculture and the Pennsylvania Department of Education, that administers the Summer Food Service Program for school age children; and Penn State University. An average of 24 attendees were at each of these sessions. In addition to food service employees and youth, other attendees at these events included summer feeding program personnel, local farmers, produce distributors, and school nutritionists. The main goal of these events was to share information about the GAP/GHP process, and good food practices, while helping school food service employees and youth learn where their food comes from and the efforts that are made to help keep it safe.</p> <p>The final type of outreach occurred in the form of auditors attending two yearly events that had state-wide reach. One of the events is the annual Mid-Atlantic Fruit and Vegetable Convention, held in January. GAP/GHP auditors shared a booth at this event with the PDA Bureau of Marketing and handed out information on the auditing programs and FSMA. This conference has an annual attendance of over 400 with growers from across Pennsylvania, as well as from New Jersey, Maryland and Virginia in attendance. The other event is the Pennsylvania Farm Bureau Health and Safety Fair, held in November. Over 100 farmers attend this event. Auditors set up a booth at this fair and handed out GAP/GHP audit information, as well as FSMA information. Traffic at the booths for both events was heavy, with auditors involved in extensive conversation with event goers.</p> <p>The work plan for this project also specified that PDA fruit and vegetable inspectors and auditors would receive training if opportunities became available. A total of seven (7) auditors and inspectors attended seven (7) different types of trainings throughout the course of the grant period. Training topics included Listeria (presence in packing houses); GAP Train the Trainer; Critical Writing, GAP/GHP New Auditor training; and Mushroom GAP.</p> |
| Goals and Outcomes Achieved: | <p>Meeting and conference outreaches, as well as on-farm mock audits were developed to be able to bring information about the USDA GAP/GHP auditing program, administered by PDA; in addition to information about the FSMA Produce Rule; out to farmers and growers in a face-to-face manner, and in locations near to them. Growers are beginning to feel the pressure of needing to comply with the FSMA Produce Rule, and the uncertainty of how to go about obtaining the information they need. The project’s intention was to continue progress made during previous grant projects to increase awareness, provide educational information, and increase the number of GAP/GHP audits requested by Pennsylvania Growers.</p> <p>The original project work plan specified a minimum of five (5) outreach events, so the actual number accomplished was significant – over three times the original indicated. Approximately 260 persons statewide participated in mock audits and meetings; with an estimated 400 individually reached during the informational booth outreaches at conferences (based on the</p>  |



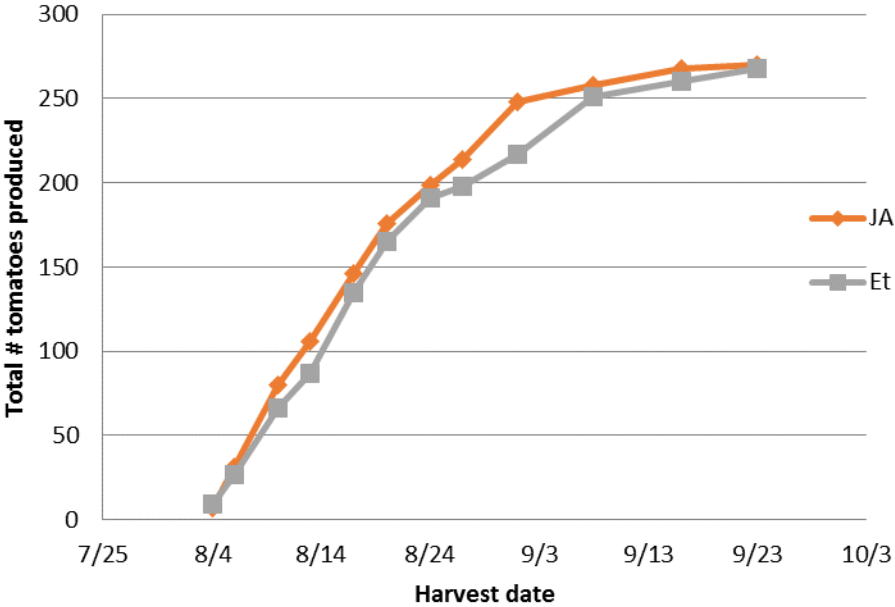
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|                  | <p>number of handouts that were given out).</p> <p>An additional goal of the project was to increase the number of GAP/GHP audits requested by 5%. In the 24-month period prior to the beginning of this project, 390 audits were performed on Pennsylvania farms. During the 24 months after the start of this project, 503 audits were performed, indicating a more than 7% increase in the number of audits requested and performed. The goal was exceeded.</p> <p>The final goal of the project was to provide training for inspectors. No concrete goal for training provision was established, just that it would be scheduled as it became available. Over the course of the project, seven (7) inspectors were able to attend 7 different types of training, increasing their knowledge and adding value to their interchange with producers.</p>   |
| Beneficiaries:   | <p>Those who benefitted from this project are varied and numerous. Specialty crop producers, their families, neighbors, and friends benefitted as they learned about GAP/GHP and the FSMA Produce Rule; and information was shared. This ultimately will help ensure a safer food supply. Volume food buyers and those they service learned of the connection between food safety programs and the produce they purchase. PDA staff fruit and vegetable inspectors and auditors received valuable continuing education.</p> <p>Eighty-two (82) producers attended mock audits throughout the state. One hundred sixty-one (161) attendees were present at volume food buyer meetings and presentations. Several hundred growers received information at conferences. Seven (7) inspectors/auditors received specialized training.</p> <p>More growers will be able to sell their products to Pennsylvania volume food outlets because their operations now have verified food safety processes in place. This will keep products in Pennsylvania and potentially increase the amount of Pennsylvania products that are grown and sold within the state, strengthening the Commonwealth's economy.</p> <p>Pennsylvania produce growers are now also becoming more familiar with the concepts and requirements of the FSMA Produce Rule. They realize that it is not something that is going to "go away" and that it is best they find out what resources are available to help them prepare for compliance.</p> |
| Lessons Learned: | <p>The main challenges of this project were finding locations and times that were mostly likely to reach the greatest numbers of attendees. It continues to be necessary to bring information out to growers in the areas where they are. Coordinating that with busy planting and harvest seasons and weather issues during farms' slower months is complicated, but with some ingenuity, can be accomplished.</p> <p>Being open to unique opportunities also helped with outreach efforts. The Farm to School events were an idea that came about without much planning, based on a request from the Department of Education.</p> <p>The part of the project what was not completed – the videos – taught project participants that, in order to stay current, better forethought will need to be given when choosing media formats.</p>  |
| Contact Person:  | <p>Nancy Jury, Assistant Director, Bureau of Food Safety and Laboratory Services, Pennsylvania Department of Agriculture<br/>717-787-4315<br/>njury@pa.gov</p>  |

| <b>Project 13</b> | <b>Farm Succession for Specialty Crop Growers in Western Pennsylvania</b>   |
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| Project Summary:  | <p>According to 2012 NASS data the average age of the Pennsylvania farmer showed a very slight decrease from 56.2 years old in 2011 to 56.1 years in 2012. A positive sign but the overall results remain staggering. In 2012 Pennsylvania lost 4268 farmers under 25 – 54 years old from 2011 to 2012 and age 55 – over 75 increased by 409 farmers. 3861 PA farms vanished for a total lose of 105,830 acres. Therefore much work needs completed in order to safeguard the specialty crop farmer as well as the specialty crop farm in Pennsylvania.</p> <p>Specialty crop farmers in western Pennsylvania do not have the required tools to move forward with succession planning for the farm. They want to develop succession plans with the next generation and don't know where to start and have requested help from PA Farm Link(PFL). PFL will hold two succession workshops in western PA and provide follow up facilitation to specialty crop farm families.</p> <p>At the MAFVC specialty crop farmers pledged their support and event promotion through Greenstar Cooperative, Inc. farmers' cooperative which serves western PA and Ohio growers to promote an event in western PA.</p> <p>IFTN Certified Succession Coordinators will also be available to facilitate for farm families through this program. The facilitators will also follow up with farm families holding them accountable for completing succession planning steps.</p> <p>Succession planning assures specialty crop farms move forward to the next generation and remain in continued production for years to come.</p> |
| Project Approach: | <p>Three farm succession workshops were planned, speakers and facilitators were confirmed and agenda finalized, presentations reviewed with presenters, and workshops were carried out in the western Pennsylvania region for specialty crop producers.</p> <p>Pennsylvania Farm Link (PFL) staff distributed promotional materials through social media avenues. They also spoke directly to specialty crop farmers attending trade shows and events including PASA Conference, MAFVC, Keystone Farm Show, PA Farm Show and Western PA Fruit and Vegetable Growers seminar. Press releases were sent to local and regional papers and to other organizations for distribution.</p> <p>Evaluations were developed to use at both workshops and during follow up survey of workshop participants. PFL staff ensured evaluations were completed, tallied and the results utilized for reporting purposes. Feedback provided information regarding future program topics specialty crop producers were most interested in.</p> <p>The project leader met with IFTN Certified Succession Coordinators to review their roles and the goals for facilitation with specialty crop farmers.</p> <p>Ag Attorney Mr. Robert Clark, New Wilmington, PA shared estate planning, legal, business and</p>   |

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|                              | <p>tax implications of specialty crop farm succession planning. Darlene Livingston, PFL Executive Director and fourth generation farmer presented human relationship and communications issues on the family farm. Financial professionals shared their expertise on financial challenges of transitioning a family farm. Specialty crop farmers served on a farmers’ panel providing the pros and cons of their farm succession/transition experiences and provided related suggestions.</p> <p>Participants reported the following increase in knowledge of legal aspects of farm succession 100% moderate to considerable knowledge following the workshop. While 30% had reported minimal and 60% moderate knowledge prior to the workshop.</p> <p>Farmers showed increased knowledge of communication about succession planning as 100% moderate to considerable knowledge while prior to the events 40% of farmers stated minimal knowledge of communication about succession/transition and 60% moderate.</p> <p>Prior to the workshops 100% of participants were minimal to moderately likely to update estate planning documents and utilize the farm succession resources such as workbooks and facilitators following the workshop 100% were very likely or moderately likely to update estate plans and use available resources.</p> <p>Prior to the events 100% of farmers stated they were not likely or moderately likely to develop succession legal documents following the workshop 100% were very likely or moderately likely to utilize legal information learned to develop the proper succession documents for their farms.</p> <p>Specialty crop farmers embraced farm meetings as 71% held farm meetings to discuss and implement farm succession/transition work for their farms.</p> |
| Goals and Outcomes Achieved: | <p>62 specialty crop farmers participated in the farm succession/transition programs which were planned and carried out. While the primary target audience was western Pennsylvania specialty crop growers, specialty crop producers from other areas of Pennsylvania attended the workshops too.</p> <p>51 participants completed steps in farm succession/transition who had not actively carried out any farm succession related work prior to the workshops. While the target was 75% of specialty crop farmers, 82.3% of the actual participants carried out farm succession related work following the workshops.</p> <p>44 farmers held farm meetings with others involved on the specialty crop farm operation. The farm meetings led to positive interaction and action steps forward in farm succession/transition planning for western Pennsylvania as well as Pennsylvania specialty crop farmers. 71% of specialty crop farmers held farm meetings this is a 21% increase over the target number of 50% of the farmers. Specialty crop farmers saw the positive impact of the increased communication and positive results farm meetings brought and therefore implemented them on a larger basis than originally anticipated. This will provide long term positive impact for specialty crop farm businesses. Dr. David Kohl, Professor Emeritus indicates farms who hold regular farm meetings are 20% more profitable than those who do not.</p>   |

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| Beneficiaries:    | <p>The target audience were western Pennsylvania specialty crop farmers and Ohio specialty crop farmers were invited to participate as well. However, the actual participants were from 62 western Pennsylvania region as well as central and other areas of Pennsylvania. Western PA and Pennsylvania farmers attended workshops and carried out steps in farm succession. All farm families who attended the workshops benefited through the opportunity to discuss one challenged and potential solution for their farm succession planning.</p> <p>Pennsylvania’s rural economy relies on successful farm businesses across Pennsylvania for stability and local positive economic impact as the farm businesses invest financially in employees and other local businesses in the local region.</p>  |
| Lessons Learned:  | <p>While the project started off slow with the lowest attendance at the first workshop in the far reaches of western Pennsylvania the momentum grew and other workshops was more conveniently located to a higher population of specialty crop producers closer to areas of greater consumer population that creates the markets specialty crop producers rely on. It became apparent that it’s best to hold workshops in areas with easy access to larger roads for ease of travel as well as in areas.</p> <p>It also was surprising that the Ohio specialty crop farmers did not take advantage of the program that was held close to the Ohio border in Mercer, PA.</p> <p>Other specialty crop producers from central Pennsylvania chose to participate in workshops even though they were not the targeted group of specialty crop producers. All were welcomed to participate.</p> <p>Honest sharing by farmer panel members was amazing and humbling however the Pennsylvania Farm Link staff always share openly and honestly about their farm transition experiences, both positive and negative, and it’s felt others are more comfortable sharing as the standard is set by the presenters. It becomes.</p> |
| Contact Person:   | <p>Darlene Livingston<br/>724-541-5717<br/>daliving@pafarmlink.org</p>  |
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| <b>Project 14</b> | <b>Turning on Natural Pest Resistance in Tomato and Pepper Using Seed Treatments</b>  |
| Project Summary:  | <p>Pesticides are costly to growers, pose environmental risks, may have non-target effects to pollinators, and in some cases, pose danger to people, especially children. Pests are becoming resistant to many pesticides thus reducing the available arsenal for pest management. Thus, there is a growing need for new approaches to pest management that do not rely on conventional pesticides. The treatment of seeds with natural plant hormones provides a revolutionary approach to “vaccinate” plants and protect them against insect pests. This approach is especially appealing because of low cost, low toxicity, ease of treatment, and it involves the use of natural compounds that are eligible for organic certification. In this proposal, we tested the efficacy of using seed treatment with the plant hormone jasmonic acid to turn on the natural defenses of tomato and pepper plants against insect pests. We conducted both greenhouse and field tests to determine efficacy. We will also determine the</p>  |

|                                | impacts of these seed treatments on yield measures for tomato and peppers  |                          |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
|--------------------------------|--|--------------------------|--------------------------|--------------------------|---------------------------|------|------|----------------------------|-----|-----|-------------------------------|-----|-----|-------------------------|------|------|---------------------------|------|------|-----------------|--------------------------|--------------------------|---------------------------|-------|-------|----------------------------|-----|-----|--------------------------------|-----|-----|------------------------------|-----|------|
| Project Approach:              | <p>We tested the efficacy of using seed treatment with the plant hormone jasmonic acid (JA) to turn on the natural defenses of tomato and pepper plants against insect pests. The treated seeds were germinated in the greenhouse and young plants transplanted to the field where we monitored insect densities throughout the growing season. We also determined the impacts of these seed treatments on yield measures for tomato and peppers.</p> <p>In the field tests with peppers, we did not observe statistically significant treatment effects for jasmonic acid. There were trends toward less damage to fruit by caterpillars and higher yields, but the effects were not statistically significant at P=0.05. Overall most of the damage to fruit was the result of caterpillar feeding and not due to stink bug feeding.</p> <p>Table 1. Effects of JA seed Treatment on Yield and Damage to Green Bell Pepper Fruit</p> <table><tr><th>Yield Parameter</th><th>Control Untreated Pepper</th><th>JA Seed Treatment Pepper</th></tr><tr><td>Average fruit weight (gm)</td><td>64.7</td><td>66.4</td></tr><tr><td>Average number fruit/plant</td><td>7.4</td><td>8.0</td></tr><tr><td>Total number marketable fruit</td><td>135</td><td>154</td></tr><tr><td>% damage (caterpillars)</td><td>26.5</td><td>19.0</td></tr><tr><td>Percent unblemished fruit</td><td>60.8</td><td>66.7</td></tr></table> <p>In the field tests, with tomato we also did not observe statistically significant results except where we saw a trend towards less caterpillar damage to fruit. We had a slightly higher rate of damage to fruit by stink bug feeding in tomato with jasmonic acid seed treatments.</p> <p>Table 2. Effects of JA Seed Treatment on Yield and Damage to Tomato Fruit</p> <table><tr><th>Yield Parameter</th><th>Control Untreated Tomato</th><th>JA Seed Treatment Tomato</th></tr><tr><td>Average fruit weight (gm)</td><td>159.6</td><td>163.2</td></tr><tr><td>Average number fruit/plant</td><td>9.0</td><td>9.2</td></tr><tr><td>% damaged fruit (caterpillars)</td><td>9.2</td><td>6.3</td></tr><tr><td>% damaged fruit (stink bugs)</td><td>4.9</td><td>10.1</td></tr></table> <p>We also considered tomato fruit production during the field growing season. Our results indicate a trend of slightly earlier production of tomato in the JA treatment compared to the control treatment (=ET).</p> | Yield Parameter          | Control Untreated Pepper | JA Seed Treatment Pepper | Average fruit weight (gm) | 64.7 | 66.4 | Average number fruit/plant | 7.4 | 8.0 | Total number marketable fruit | 135 | 154 | % damage (caterpillars) | 26.5 | 19.0 | Percent unblemished fruit | 60.8 | 66.7 | Yield Parameter | Control Untreated Tomato | JA Seed Treatment Tomato | Average fruit weight (gm) | 159.6 | 163.2 | Average number fruit/plant | 9.0 | 9.2 | % damaged fruit (caterpillars) | 9.2 | 6.3 | % damaged fruit (stink bugs) | 4.9 | 10.1 |
| Yield Parameter                | Control Untreated Pepper   | JA Seed Treatment Pepper |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| Average fruit weight (gm)      | 64.7   | 66.4                     |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| Average number fruit/plant     | 7.4  | 8.0                      |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| Total number marketable fruit  | 135  | 154                      |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| % damage (caterpillars)        | 26.5   | 19.0                     |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| Percent unblemished fruit      | 60.8   | 66.7                     |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| Yield Parameter                | Control Untreated Tomato   | JA Seed Treatment Tomato |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| Average fruit weight (gm)      | 159.6  | 163.2                    |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| Average number fruit/plant     | 9.0  | 9.2                      |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| % damaged fruit (caterpillars) | 9.2  | 6.3                      |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |
| % damaged fruit (stink bugs)   | 4.9  | 10.1                     |                          |                          |                           |      |      |                            |     |     |                               |     |     |                         |      |      |                           |      |      |                 |                          |                          |                           |       |       |                            |     |     |                                |     |     |                              |     |      |

|                                     |  <table border="1"> <caption>Estimated data from the line graph</caption> <thead> <tr> <th>Harvest date</th> <th>JA (Total # tomatoes produced)</th> <th>Et (Total # tomatoes produced)</th> </tr> </thead> <tbody> <tr> <td>8/4</td> <td>10</td> <td>10</td> </tr> <tr> <td>8/11</td> <td>80</td> <td>65</td> </tr> <tr> <td>8/14</td> <td>110</td> <td>90</td> </tr> <tr> <td>8/21</td> <td>175</td> <td>165</td> </tr> <tr> <td>8/24</td> <td>200</td> <td>190</td> </tr> <tr> <td>8/31</td> <td>250</td> <td>220</td> </tr> <tr> <td>9/7</td> <td>260</td> <td>250</td> </tr> <tr> <td>9/14</td> <td>270</td> <td>265</td> </tr> <tr> <td>9/21</td> <td>275</td> <td>270</td> </tr> </tbody> </table>  | Harvest date                   | JA (Total # tomatoes produced) | Et (Total # tomatoes produced) | 8/4 | 10 | 10 | 8/11 | 80 | 65 | 8/14 | 110 | 90 | 8/21 | 175 | 165 | 8/24 | 200 | 190 | 8/31 | 250 | 220 | 9/7 | 260 | 250 | 9/14 | 270 | 265 | 9/21 | 275 | 270 |  |
|-------------------------------------|--|--------------------------------|--------------------------------|--------------------------------|-----|----|----|------|----|----|------|-----|----|------|-----|-----|------|-----|-----|------|-----|-----|-----|-----|-----|------|-----|-----|------|-----|-----|--|
| Harvest date                        | JA (Total # tomatoes produced)   | Et (Total # tomatoes produced) |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 8/4                                 | 10   | 10                             |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 8/11                                | 80   | 65                             |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 8/14                                | 110  | 90                             |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 8/21                                | 175  | 165                            |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 8/24                                | 200  | 190                            |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 8/31                                | 250  | 220                            |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 9/7                                 | 260  | 250                            |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 9/14                                | 270  | 265                            |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| 9/21                                | 275  | 270                            |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| <p>Goals and Outcomes Achieved:</p> | <p>All of the research goals of the project were completed. We determined that the seed treatments could negatively impact fruit feeding caterpillars in greenhouse settings. The caterpillar pressure we observed in the field was minimal during the field tests that we conducted; however, there was a trend towards reduced feeding damage.</p> <p>One of the concerns that we observed from earlier greenhouse experiments was that yield measures might be reduced by the JA seed treatments. However, this was negated in field grown tomatoes. This is especially significant, as a yield reduction would likely severely restrict the utility of these seed treatments.</p> <p>At the present time, it is too early to make recommendations for the JA seed treatments. We believe the greatest utility may be for the transplant industry- where plants are grown in the greenhouse and then sown in the field as young plants. This approach would likely mitigate any potential reduction of yield that we observed with the greenhouse experiments. Also, this technology is very compatible with other pest management practices such as the use of soil amendments, biocontrol, and biopesticides.</p> |                                |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |
| <p>Beneficiaries:</p>               | <p>The primary beneficiaries will be growers. Results from this study were presented at the Advanced Biocontrol School held Nov. 3-4, 2016 at the Penn State Extension Lancaster County Office. More than 50 people were in attendance and the workshop was live-streamed to at least an additional 15 sites including Cargill industry sites. A very conservative estimate is that over 100 hundred growers, educators and agrichemical industry people were in attendance. The talk focused on using seed treatments and the use of commercially available biopesticides. Future presentations to growers are planned which will incorporate the findings from this study.</p>   |                                |                                |                                |     |    |    |      |    |    |      |     |    |      |     |     |      |     |     |      |     |     |     |     |     |      |     |     |      |     |     |  |

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| Lessons Learned:  | The use of jasmonic acid seed treatments offers promise, especially in cases of field grown vegetables. A small yield loss is observed under greenhouse conditions, which may limit its utility in greenhouses. However, combining seed treatments with certain soil amendments may overcome these issues where yields may be suppressed with jasmonic acid treatments. The best options for growers may be the incorporation or integration of seed treatments with other management options such as biocontrol, biopesticides, and soil amendments. Future studies are needed to develop the optimal plan for integrated pest management.   |
| Contact Person:   | Name the Contact Person for the Project: Gary W. Felton<br>Telephone Number: 814-863-7789<br>Email Address: gwf10@psu.edu   |
|                   |   |
| <b>Project 15</b> | <b>Vegetable Industry Strategic Planning Implementation</b>   |
| Project Summary:  | <p>This project built on a previously funded Specialty Crops Block Grant. In 2013, recognizing a need to address current and future challenges collectively and purposefully, the Pennsylvania Vegetable Marketing and Research Program (PVMRP) and the Pennsylvania Vegetable Growers Association (PVGA) embarked on a strategic planning process with support from the Pennsylvania Department of Agriculture (PDA) through a Specialty Crops Block Grant. The strategic planning process was conducted by Penn State Extension and completed in 2014. The 2014 Strategic Plan developed for the Pennsylvania industry identified five strategic objectives and priorities:</p> <ul style="list-style-type: none"> <li>• Marketing: Assure and expand market access and opportunities for PA vegetable growers.</li> <li>• Research: Support and disseminate research that is timely and relevant for a profitable PA vegetable industry.</li> <li>• Education: Help members stay up-to-date and informed about topics relevant to the PA vegetable industry.</li> <li>• Advocacy: Represent the interests of the PA vegetable industry to federal, state and local policy-makers.</li> <li>• Crisis Management: Be proactive in assisting the PA vegetable industry in managing and responding to crises.</li> </ul> <p>In addition to identifying key strategic objectives and priorities for the industry, the Strategic Plan authors concluded the following:</p> <p><i>A critical outcome of the strategic planning process is recognition of the need for additional capacity to enable both organizations to implement this strategic plan and meet the needs of the vegetable industry. While volunteers from the board and general membership can take on some of the burden, many of the strategic priorities require professional resources...[for example] Once [a] plan is developed, additional assistance will be required to operationalize it and sustain organizational capacity to implement when a crisis occurs.</i></p> <p>The first phase of this project (October 1, 2014 – originally projected until September 30, 2015 but extended to September 30, 2017), covered in this project focused on immediate industry needs. There were four project components completed:</p> <ol style="list-style-type: none"> <li>1) Implementation of changes to the PVMRP's promotion program that focus resources on fewer strategies while maintaining core efforts</li> <li>2) Public relations and crisis management procedures</li> </ol> |

|                   |   |
|-------------------|---|
|                   | <ol style="list-style-type: none"> <li>3) A business development plan for the Pennsylvania Vegetable Growers Association</li> <li>4) Update and expand relevance of both organizations’ web-based communications platforms</li> </ol> <p>A fifth component included in the original proposal which was not able to be implemented was developing recommendations for low cost assistance to PA vegetable growers to expand food safety compliance and certification throughout the state.</p> <p>The second phase (October 1, 2015 and beyond, and not covered by this grant) will focus on:</p> <ol style="list-style-type: none"> <li>1) Increasing the participation rate in the Pennsylvania Vegetable Marketing and Research Program assessment</li> <li>2) Expanding organizational capacity to deliver additional services to industry stakeholders</li> </ol>   |
| Project Approach: | <p><b>1. Changes to PVMRP Promotion Program</b></p> <p>The first component of the project was to implement a recommendation to PVMRP to eliminate several of its promotion activities and concentrate PVMRP’s promotions on its “August is Pennsylvania Produce Month” promotion. This was a recommendation from Jeff Manning, a consultant hired with a state grant from the Pennsylvania Department of Agriculture in 2014. The initial plan was to explore working with St. Joseph’s University, whose food marketing program has worked closely with the Pennsylvania Department of Agriculture on its PA Preferred® program, to develop a marketing plan. PVMRP contacted them but St. Joseph’s proposed rather extensive research to further evaluate the Program’s promotion efforts. PVMRP felt this would be a repetitive effort of the fees paid to Jeff Manning for an expert evaluation of the Program’s promotion’s efforts.</p> <p>PVMRP then proceeded to eliminate its annual season-long press relations effort and its vegetable recipe contest to concentrate its promotions efforts on its PA Produce Month promotion for 2015 as recommended by Mr. Manning. The Program did elect to continue its ongoing distribution of point-of-purchase materials because it still had considerable inventories of items on hand and because the point-of-purchase items are a tangible benefit of the Program to the growers paying the annual assessment to the Program. The Program used grant funds to print new supplies of posters and price cards specifically designed for the “August is PA Produce Month” promotion. These point-of-purchase materials were distributed directly to interested growers who ordered them from the Program. They were also offered for sale at a nominal price of \$2 at produce auctions across the state, allowing buyers who purchase local produce at the auctions to participate in the August promotion as well. Lastly, these posters and price cards were offered to supermarket chains across the state – reaching about 200 or more supermarkets a year.</p> <p>In the past the Program had used radio advertisements/sponsorships to make consumers aware of fresh, local produce during the month of August. For 2015, the Program decided instead to develop a social media campaign during Produce Month. It contracted with Penn State Extension to develop and conduct the social media campaign using Facebook, Twitter, Instagram and Pinterest. It also used grant funding in 2015 to sponsor the Vegetable Day cooking demonstrations at the 2015 Pennsylvania Farm Show in January.</p> <p>In 2015, PVMRP staff created an online directory of retail Farm Markets, Farmers’ Markets and CSAs, from information submitted by growers in the Program. A separate online directory of growers selling their crops wholesale was created where the growers are listed by crop produced. Both of these directories are posted on the Program’s website <a href="http://www.paveggies.org">www.paveggies.org</a>. This directory was updated in</p> |



2016 and 2017.

In 2016, PVMRP contracted with Kitchen Table Consultants (KTC), a marketing and management consultant group, to assist the Program in developing a more robust and effective “August is PA Produce Month” promotion effort. They worked with Penn State Extension on the social media campaign but also developed custom content for the Program’s website at [www.paveggies.org](http://www.paveggies.org) for both consumers and growers. The consumer information included personal advice and recipes from several professional chefs. KTC also conducted a press relations effort centered around August. The Program again used grant funding in 2016 to sponsor the Vegetable Day cooking demonstrations at the 2016 Pennsylvania Farm Show in January.

In 2017, PVMRP again contracted with KTC to implement an enhanced “August is PA Produce Month” promotion. KTC assumed total responsibility for the social media campaign. They created additional “tools” that growers could use in making the most of the Produce Month promotion at their markets. They also undertook an expanded press relations campaign that included releases prior to August as well as after August. Additional consumer informational content was added to [www.paveggies.org](http://www.paveggies.org) website, including tips and recipes from professional chefs. The following is a report of this year’s promotion efforts:

#### Web Content

KTC added significant amounts of content and value to the [www.paveggies.org](http://www.paveggies.org) website in connection with the 2017 August is Pennsylvania Produce Month promotion. KTC updated custom website content to remain relevant throughout the year with several sections of custom content developed to support the PA Veggies brand, and position it as a content expert for all things vegetable.

- Infographic: Guide to Finding, Choosing, Storing, Cooking, and Preserving PA Vegetables
- 5 Blogs relating back to each press release in August, including new recipes from top PA chefs
- Toolkit for farmers: marketing calendar, promotion ideas, tips and tools for engaging consumers and press, shareable social media images and eblast headers
- Uploaded 2017 press releases

#### Press Releases

The Program issued eight press releases July through October, with a final press releases scheduled for November in connection with the August is Pennsylvania Produce Month. From July 18 to October 31, content from these releases appeared in 83 articles (51 in print; 32 online) creating 2,010,029 impressions. This shows an increase of 35 more articles and 690,169 (35%) more impressions over 2016’s 48 articles reaching 1,319,860 readers.

The weekly press releases in August to promote PA vegetables focused on the goals of highlighting the diversity of PA grown crops and encouraging consumers to use more fresh, local PA produce through offering accessible ways to prepare and enjoy them. Press releases after the conclusion of PA Produce Month were geared toward encouraging consumers to continue to source local PA produce, including recipes and resources for sourcing produce and locating PA produce farms.

PA Produce Month press releases:

- July: Celebrate Pennsylvania Produce Month this August with Top Chef Recipes, Pop up Events and Relishing the Bounty from Local Farms
- August wk 1: How Top Pennsylvania Chefs Transform Local Veggies in Their Kitchens
- August wk 2: Agriculture Secretary Honors Generous Produce Farmers

- August wk 3: Celebrate PA Produce Month - Drink Your Veggies!
- August wk 4: 5 Tips to Get Your Kids on the Veggie Bandwagon (Tricks Included!)
- August wk 5: 4 Reasons the Veggie Lifestyle is For Everyone
- September: Sweet Potatoes, Broccoli, and Squash! Oh My!
- October: Autumn is the PA Pumpkin's Time to Shine

#### Pop Up Events

KTC conducted nine pop up events throughout the month of August - eight located in Central and Eastern PA at farmers' markets and county fairs; one located in Western PA in collaboration with the PA Department of Agriculture and Secretary Russell Redding, along with Feeding PA and the Pittsburgh Community Food Bank, as a special event to recognize farmers that donate produce and participate in government programs geared toward getting fresh foods into the hands of those with limited resources.

The eight pop ups in Central and Eastern PA focused on interactive opportunities for children and adults. The themes for these included:

1. Dirt Therapy - an opportunity for kids to dig up buried veggies out of a container of soil while we work with them to identify the produce and talk about the many ways to enjoy them as well as their health benefits.
2. Tomato Tasting Trail - Discover new tomato varieties and perfect food pairings as you stroll around the market filling your basket with August's bountiful produce offerings. Look for PA Produce Month signs to guide you, and sample summer's finest fruits of the vine on this tasty trail throughout the market. Ask your farmers about their favorite tomatoes and which varieties are best for your recipes!
3. Chopped Salad Demo - inspire even the busiest person to load up their market basket with an assortment of fresh veggies and learn how to quickly prep them into a delicious, raw salad bursting with flavor. We uncovered the ease with which someone can create a powerhouse salad in minutes and provided recipes along with veggie combination suggestions.

With potential exposure to over 30,000 consumers, 1000 direct connections were estimated - direct meaning there was a conversation and personal interaction like sharing recipes, tips for cooking seasonally, kids programming and information about PA Veggies. Many more were reached indirectly through handouts provided at the pop up events. (These stats on connections do not include social media engagement, which was a focal point for creating excitement about the activities.)

#### Social Media

The PA Produce Month social media campaign was thorough, with continual custom posts on Facebook and Instagram scheduled regularly and crafted for consumer engagement. Between June 1, 2017 and October 31, 2017, KTC published 132 Facebook posts, roughly every other day. Despite what we know to be an effective campaign, some Facebook data does not accurately reflect its impact. Facebook in particular has analyzed over 880 million posts from publisher and brand pages to discover that there has been a clear decline in overall Facebook user engagement since January 2017. Reasons for this are speculated to be Facebook's changing algorithms that determine what appears in users' feeds, as well as overall more content to compete with on Facebook. Across all Facebook accounts, page administrators are seeing 30% lower organic reach.

Despite this overarching Facebook trend, the PA Veggies page campaign still saw success. Even though

Page engagement increased by a mere 1%, the Page increased user likes by 51 from July through August. Statistics for Posts engagement, reach, and impressions July through August is where we see vast improvement:

- 25% Increase in Post Engagement (2016: 664 vs. 2017: 875)
- 33% Increase in Post Reach (2016: 14,592 vs. 2017: 21,835)
- 20% Increase in Post Impressions (2016: 28,649 vs. 34,989)

We found that posts which portrayed a sense of community and educated the consumer typically delivered the quality engagement we were aiming for. Below are some posts that we collectively identified from the 2017 campaign as showcasing this quality engagement:







**PA Veggies**  
 Published by Angela Corrado · 7 · August 18 ·

Veggie knowledge is a powerful thing! Here are a few important and fun facts to send you into the weekend. Now go connect with your local farmers and veg on! #paveggies #paproducemonth

4,173 people reached

98 Reactions, Comments & Shares

|            |            |              |
|------------|------------|--------------|
| 57 Like    | 14 On Post | 43 On Shares |
| 4 Love     | 1 On Post  | 3 On Shares  |
| 1 Comments | 0 On Post  | 1 On Shares  |
| 36 Shares  | 34 On Post | 2 On Shares  |

212 Post Clicks

|                 |               |                 |
|-----------------|---------------|-----------------|
| 115 Photo Views | 0 Link Clicks | 97 Other Clicks |
|-----------------|---------------|-----------------|

NEGATIVE FEEDBACK

|                  |                  |
|------------------|------------------|
| 1 Hide Post      | 0 Hide All Posts |
| 0 Report as Spam | 0 Unlike Page    |


Insights activity is reported in the Pacific time zone. Ads activity is reported in the time zone of your ad account.

4,173 people reached


View Promotion

Chrissie DeGarmo, Mary Kay Schatz Hilyer and 13 others · 34 Shares

Like Comment Share


**PA Veggies**  
 Published by Angela Corrado · 7 · July 22 ·

TAG your favorite farm/farmer! #paveggies



Get More Likes, Comments and Shares  
Boost this post for \$20 to reach up to 5,900 people.

573 people reached

Boost Post

12 3 Comments 1 Share

Like Comment Share

**573** People Reached

**25** Reactions, Comments & Shares

|            |            |             |
|------------|------------|-------------|
| 19 Like    | 11 On Post | 8 On Shares |
| 1 Love     | 1 On Post  | 0 On Shares |
| 3 Comments | 3 On Post  | 0 On Shares |
| 2 Shares   | 1 On Post  | 1 On Shares |

**31** Post Clicks

|               |               |                 |
|---------------|---------------|-----------------|
| 7 Photo Views | 1 Link Clicks | 23 Other Clicks |
|---------------|---------------|-----------------|

**NEGATIVE FEEDBACK**

|                  |                  |
|------------------|------------------|
| 0 Hide Post      | 1 Hide All Posts |
| 0 Report as Spam | 0 Unlike Page    |

Reported stats may be delayed from what appears on posts

In 2017, PVMRP also pivoted the PA Veggies campaign toward farmers, encouraging them to use the hashtag #paveggies to promote their products and services via their pages. By enlisting these farmers as “PA Veggies ambassadors” and supplying them with graphics, copy, tips, and instructions, the campaign undoubtedly had further reach and engagement. We quickly became aware of the increased participation of farmers using the #paveggies hashtag this year and specifically saw 50 more #paveggies posts on Instagram alone in 2017 between the months of June and October, than we did in 2016. We also enlisted a re-posting strategy in 2017 which, in turn, amplified the reach and engagement of the farmers’ posts by frequently exposing them to the PA Veggies’ Instagram audience. By empowering the farmers’ to tell their personal stories, PVGA created an environment for direct, authentic and quality engagement between the producer and consumer.

Facebook does remain the most popular social network worldwide, and Instagram’s focus on visuals makes it an obvious outlet for exposing vegetable products to consumers. Instagram’s user base is also now more than double the size of Twitter’s user-base, which unrelatedly consists largely of news/political figures. When looking beyond size to demographics, Facebook and Instagram are also the wise choices, with both platforms offering the most female users, who are proven to possess the

household purchasing power. They also have the most users in PVMRP's desired age range.

Besides the improvements to the PVMRP website, press outreach, pop up events, and social media campaign noted above, the Program again distributed its Produce Month point-of-purchase materials. Growers ordered 71 Produce Month point-of-purchase kits directly from the Program. Supermarket chains/wholesalers, including Acme Markets, Supervalu, Karns Family-Owned Markets and Four Seasons Produce, requested Produce Month materials for 256 stores. The Program also sent 210 Produce Month kits to produce auctions across the state for them to offer for sale to their buyers at the nominal price of \$2.

## **2. Public Relations and Crisis Management Procedures**

One of the vulnerabilities of the Pennsylvania vegetable industry identified in the strategic planning process was that the industry was unprepared to react to a public relations crisis involving the state's industry, such as the spinach contamination crisis in California in 2006 and the cantaloupe contamination crises in Colorado and Indiana in 2011. It was determined that the Association, PVGA, would have the best ability to serve as the industry representative in the case of a crisis. Watson and Green LLC, of Washington, DC, a nationally recognized consulting firm with expertise in crisis management in the food industry, was retained by the Association to develop a crisis management plan and training for the Association in dealing with a food safety or other crisis in the Pennsylvania industry. Amy Philpott of Watson and Green developed a customized crisis management plan and in-person training for the PVGA Executive Committee on handling an industry/association crisis which she presented in December 2015 in a half-day workshop. This was followed up with an on-camera training for PVGA representative to practice responding to the news media in a crisis situation. This training was held in January 2017 at the Mid-Atlantic Fruit and Vegetable Convention.

While the above efforts were focused on enabling the Association to respond to an industry crisis on behalf of the industry, Ms. Philpott also provided a series of monthly articles for the Association's newsletter to inform individual growers on how they should be prepared for dealing with a recall of product from their farm. This six-part series ran in the Pennsylvania Vegetable Growers News from July to December 2015. Ms. Philpott also spoke to growers at the Food Safety/Crisis Management session at the 2016 Mid-Atlantic Fruit and Vegetable Convention. At the 2017 Mid-Atlantic Convention, she presented a half-day workshop entitled Recall Readiness – What to Do When FDA Calls that provided an in-depth discussion of how to react when FDA asks for a recall of a grower's product. Participants in this workshop were invited to sit in on the on-camera training session for the PVGA Executive Committee referenced above.

## **3. Business Development Plan**

This third component of the project was initially intended to be contracted to Robert Amsterdam, a former director and president of the Association. However, prior to final release of the grant funds he took a full-time position with Feeding America. Thus Mr. Amsterdam was unable to devote the necessary time needed to develop a business development plan that would allow PVGA to expand its staff capacity. A proposal was made to the PVGA Board at its March 2016 meeting to assemble a task force to complete the project. The Board agreed and approved the action. Shortly thereafter the

PVGA Capacity Development Task Force (PCDTF) was assembled and comprised of the following Pennsylvania Vegetable Growers Association members: Robert Amsterdam (former board member and past President), William Troxell (PVGA Executive Secretary), Arthur King (former board member and past President), Kenneth Martin (current board member and past President) and Rita Resick (Association member and subsequently elected as a board member). The Task Force undertook an aggressive schedule of regular conference calls beginning in early April 2016 and held two face-to-face meetings in late spring, with the goal of presenting a Capacity Development Plan draft to the PVGA Board at its December 2016 meeting.

The Capacity Development Task Force began its work with a thorough review of the 2014 Strategic Plan and the current Workplan Development 2016 document, which is an internal Association document that looks at next steps to implement the strategic plan. The Task Force then engaged in a formal capacity assessment and gaps analysis exercise in order to develop a deeper understanding of capacity gaps and barriers that would inhibit meaningful implementation of the Strategic Plan. For example, “Program Development” (i.e., development of new or enhanced member services, various events such as a webinar series, etc.) is addressed in the Strategic Plan and based on the assessment exercise the Association will need to build the necessary capacity in order to implement such programs. Specific needs include fund development to support and sustain new programs (or enhance existing programs) and evaluation and performance metrics will be necessary to operationalize the Strategic Plan. Delivery of programs will necessitate development of human resources capacity and the commensurate requirements that go along with staffing (H.R. policies, funding, etc.). Another missing piece is development of increased communications capacity to support all the programs and initiatives laid out in the Strategic Plan. This includes not just stepping up the Association’s web presence but development of a robust social media and enhanced public relations presence. Finally, as capacity that is focused on program, services and communications expands, so too does the need to expand capacity at both the Executive and Administrative functions.

While the initial work of the Capacity Development Task Force focused on capacity requirements to operationalize the Strategic Plan, exploring the ways and means of funding capacity expansion and program implementation became another focus area. The Task Force researched various types of funding streams commonly available to nonprofit organizations. Subsequently the Task Force researched applicable 501 (c) status’ to determine if its current 501 (c) 5 legal status might be a disadvantage with respect to future funding streams to support implementation of the Strategic Plan and commensurate capacity expansion. The Task Force consulted with the Pennsylvania Association of Nonprofit Organizations (PANO) to get further insight into this question.

Finally, the Task Force began work on Succession Planning with respect to the Association’s staff. The research provided important considerations for the Directors resulting in a recommendation that the Board develop a succession plan, utilizing some of the guidelines provided by the Task Force.

The Capacity Development Task Force identified six areas the Board needs to address in moving forward with any organizational capacity expansion:

1. Funding
2. PVGA’s 501 (c) status
3. Program development
4. Staffing
5. Succession planning



## 6. Extending the life of the Capacity Development Task Force

### Points of consideration regarding funding, 501(c) status, program development and staffing

Expanding programs and staffing to deliver additional programs and services requires a plan for ongoing funding beyond the Association's current revenues. The current 501(c)5 status of the organization inhibits its ability to attract or pursue certain types of outside grant opportunities however it is possible to fund additional staff and not change the existing nonprofit status. Before moving forward, the Association must also determine which additional programs it considers the highest priority for its members and general constituency and what will be the staffing needs of such an expansion. The Board should also determine if there are immediate staffing needs (as identified in the Strategic Plan).

#### 1. Funding: The Task Force *strongly recommended*

- Exploring new funding/revenue options that do not necessitate a change from 501 (c)5 status
- Exploring potential funding streams that would become available with a change in 501 (c) status
- Exploration of expanding funding through membership
  - Various membership & sponsorship options (opportunities)
  - Fees for services
- Exploration of various funding sources
  - Public/governmental
  - Foundations
  - industry
- Exploration of grant funding ...
  - ...to support program development per Section III of this report
  - ...to provide unrestricted support of the core mission

#### 2. Changing 501(c) status: The Task Force *strongly recommended* consideration of changing the organization's nonprofit status to 501 (c) 3 only after further research and reflection on the following points<sup>1</sup>:

- A review of the outcomes of the previous section
- 501 (c) 5
  - Benefits & disadvantages of remaining a 501 (c) 5
  - Explore options of partnering with a 501 (c) 3 organization as a fiscal agent for grant funding
  - Maintaining 501 (c) 5 status and setting up a separate 501 (c) 3
- 501 (c) 3
  - costs, impacts and process of changing the organization's nonprofit status to 501 (c) 3

<sup>1</sup>Three members of the Task Force met with the Executive Director of PANO on March 3, 2017. Most of the discussion focused on the 501 (c) status, including the process of changing from the current status and approximate costs. While the general consensus was there seemed no apparent negatives to changing from a 501 (c) 5 to a 501 (c) 3, it is a big change and worth further deliberation.

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|  | <ul style="list-style-type: none"> <li>○ Benefits &amp; disadvantages of changing to 501 (c) 3 status</li> <li>○ Outline of fund raising strategies that would benefit from the 501 (c) status change</li> </ul> <p>3. Staffing: The Task Force <i>recommended further exploration specifically regarding:</i></p> <ul style="list-style-type: none"> <li>● Immediate needs to deliver improved services as identified in the Strategic Plan</li> <li>● Explore staff-sharing with other organizations for functionality and as a means of test driving the impact of additional staff (e.g., sharing an admin or communications staff person with another nonprofit)</li> <li>● Identify additional staffing requirements to deliver any new or expanded programs</li> <li>● Identify funding and other compliance requirements necessary to hire staff (e.g., HR policies)</li> </ul> <p>4. Program expansion: The Task Force <i>strongly recommended</i> a rigorous review of the operationalization of Strategic Plan outcomes (as outlined in the Capacity Development Plan) and the current Work Plan Development document to prioritize which, if any new or expanded programs should be pursued and resourced.</p> <p><u>While not taking a position on any specific program, the Task Force <i>strongly recommended</i> investing resources into making the Crisis Management Plan fully functional.</u></p> <p>5. Succession planning: The Task Force <i>strongly recommended</i> the Board</p> <ul style="list-style-type: none"> <li>● Set up succession planning committee</li> <li>● Conduct an informal audit of the current Executive Secretary's roles &amp; functions including his financial impact (costs and benefits of his job performance [<i>which have provided a very high return to PVGA &amp; PVMRP</i>])</li> <li>● Write a clear job description for a future E.D.</li> <li>● Develop a Search &amp; Hiring Plan which addresses             <ul style="list-style-type: none"> <li>○ Candidate profile</li> <li>○ Criteria for consideration</li> <li>○ Compensation package</li> <li>○ Employee or contractor</li> </ul> </li> </ul> <p>6. Capacity Development Task Force: The Task Force <i>recommended</i></p> <ul style="list-style-type: none"> <li>● Extending task force life indefinitely until such time it becomes obsolete or it is functionally replaced by internal staffing</li> <li>● Develop job descriptions and work plan</li> <li>● Develop Succession Plan</li> <li>● Roles...             <ul style="list-style-type: none"> <li>○ Initiate next steps viz. 501 status</li> <li>○ Explore funding options and assume development role</li> <li>○ Define staffing needs and recruit staff as appropriate and required by other factors such as program development</li> <li>○ Identify potential organizations that PVGA can partner with to share staffing</li> </ul> </li> </ul> |
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|  | <p>overhead burdens</p> <ul style="list-style-type: none"> <li>○ Develop &amp; write HR &amp; other operational policies as required or appropriate</li> </ul> <p><u>Additional Task Force suggestions for Board consideration</u></p> <p><u>Develop Strategic Partnerships</u></p> <ul style="list-style-type: none"> <li>• Explore collaborative relationships with other similar nonprofit organizations <ul style="list-style-type: none"> <li>○ Possible sharing of staff for core functions such as administration and communications</li> <li>○ Utilize 501 (c) 3 status for grant funding if the organization chooses not to change from 501 (c) 5</li> <li>○ Partner on grants and projects</li> </ul> </li> <li>• Join PANO (Pennsylvania Association of Nonprofit Organizations) to utilize its legal, consulting and collaborative resources</li> </ul> <p><u>Staffing</u></p> <p>Based on the Workplan Development for 2016 and the functional analysis included in this report, a practical approach might involve elevating the position of Executive Secretary to Executive Director with enhanced responsibilities while adding one or two critical staff to assume specific day-to-day functions and responsibilities. Based on the Capacity Development Task Force analysis, communications and administrative support are two areas where the organization can benefit immediately from the addition of staff.</p> <p><u>Conclusions</u></p> <p>While it is evident PVGA lacks the staffing capacity to deliver all the programs and initiatives identified in the Strategic Plan, ramping up to full capacity in the short (and even possibly in the medium or long) term is impractical. It would be an expensive gamble that funding to support such and effort could be sustained over the near and intermediate term.</p> <p>The basic questions that must be answered before embarking on capacity development are:</p> <ol style="list-style-type: none"> <li>1. What will the changes cost? <ul style="list-style-type: none"> <li>• What are the capital costs, i.e., what is needed to <u>start</u> the change?</li> <li>• What are the operating costs (salaries, material and administrative costs)?</li> </ul> </li> <li>2. How will the changes be funded?</li> <li>3. How will the changes affect the organization, its membership and non-member constituents and the community in which it lives?</li> <li>4. Will it make a difference?</li> </ol> |
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A final draft of the Capacity Development Plan was presented to the PVGA Board of Directors at their March, 2017 meeting.

#### **4. Update and Expand Relevance of Both Organizations' Web-Based Communications Platforms**

As previously noted in the section on the first component of the project, the PVMRP website [www.paveggies.org](http://www.paveggies.org) has had a great deal of consumer information developed and added by KTC during the 2016 and 2017 seasons, including:

- 4 Reasons the Veggie Lifestyle is for Everyone
- 5 Tips to Get Your Kids on the Veggie Bandwagon
- Vegetable Grilling Guide
- Tips From PA Chefs – recipes and tips from 10 PA chefs
- How to Prepare Veggies
- How to Preserve and Can Veggies
- PA Vegetable Seasons and Buying Tips
- Infographics
  - Veggie Info Overview
  - Top Tomato Picks for Summer
  - PA Veggie Crops at a Glance
  - Guide to Winter Veggies

In addition, KTC added a “Farmer’s Toolbox” to the website for the Program’s growers to give them tips on making the most of the Program’s Produce Month promotion. The toolkit, added over the 2016 and 2017 seasons, includes:

- Preparing for Produce Month
- Social Media Tips
- Newsletter Tips
- Marketing Calendar
- Social Media Images
- Email Images
- Talking Points

As also mentioned previously, the Program staff created in 2015 and annually updated the Directory of Farm Markets, Farmers’ Markets and CSAs for consumers on the website and the Directory of Wholesale Growers for wholesale buyers. Program staff also created separate informational pages for about 20 different PA vegetable crops. The pages include tips for selecting the crops, preparing them, links to recipes, and nutritional information. These pages are accessed from a monthly (or seasonal) word “cloud” menu on the home page.

The PVGA website at [www.pvga.org](http://www.pvga.org) has also been greatly enhanced over the past two years by the Association staff. The basic information on the Association’s educational, research advocacy, and promotion activities has been updated. New sections with biographies and pictures (when available) of the Association’s past officers, current Board of Directors, Life members, winners of the Annual Award and Young Grower Award, and recipients of the Grob Memorial Scholarship have been added.

Over the past several years the Association has also been working to provide its members with regular email updates of current news and events. Originally these updates were sent out periodically and eventually moved toward one every other week. In 2017, the Association has maintained a weekly schedule with a few exceptions. For a while, articles were posted in an “Updates” section of the website and these articles were linked to in the email update. This required readers to effectively go through two or three links to eventually reach the whole article. For the last several months, the

Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

|                              |  |              |              |              |              |              |              |              |              |              |              |              |              |
|------------------------------|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|                              | excerpts of articles are included in the email update directly with the link directly to the original article rather than routing the reader through the Association’s website. This has the effect decreasing the traffic on the website but it is a better experience for the reader.  |              |              |              |              |              |              |              |              |              |              |              |              |
|                              | The project did not benefit commodities other than specialty crops   |              |              |              |              |              |              |              |              |              |              |              |              |
| Goals and Outcomes Achieved: | 1. GOAL: Increased participation in PVGA sponsored educational & outreach activities.<br>PERFORMANCE MEASURE: Number of participants in the educational meetings & related workshops at the Mid-Atlantic Fruit and Vegetable Convention (MAFVC) and other PVGA sponsored events.<br>BENCHMARK: Attendance at similar events in 2013 and 2014.<br>TARGET: 20% increase in 2015 attendance compared to the 2013-14 average at similar events.  |              |              |              |              |              |              |              |              |              |              |              |              |
|                              | The Mid-Atlantic Fruit and Vegetable Convention is the primary educational event sponsored by PVGA. While the Association does sponsor other grower educational events (field days, twilight meetings, and farm market tours) these other events are not directly organized or directly conducted by the Association. The field days are biennial events rather than annual and attendance has seemed to decline at these events. Twilight meetings are organized by local Penn State Extension Educators and the number and extent of the programing at these events varies from year to year so comparsion of attendance is difficult and not consistently tracked closely. Attendance has not increased at these events. The vegetable portion of the Mid-Atlantic Convention is, however, planned with direct involvement of the Association and the Association is responsible for the registration of vegetable growers at this event. Thus accurate records for the past 12 years are available as follows: |              |              |              |              |              |              |              |              |              |              |              |              |
|                              | <b>Registrations</b>   | <b>06</b>    | <b>07</b>    | <b>08</b>    | <b>09</b>    | <b>10</b>    | <b>11</b>    | <b>12</b>    | <b>13</b>    | <b>14</b>    | <b>15</b>    | <b>16</b>    | <b>17</b>    |
|                              | Member Registration  |              |              |              |              |              |              |              |              |              |              |              |              |
|                              | One-Day  | 313          | 298          | 282          | 308          | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
|                              | Three-Day (advance)  | 388          | 372          | 400          | 398          | 585          | 593          | 590          | 576          | 354          | 380          | 405          | 491          |
|                              | Three-Day (advance additional person)  |              |              |              |              |              |              |              |              | 241          | 249          | 308          | 361          |
|                              | Three-Day (late/walkin)  | 91           | 64           | 79           | 87           | 261          | 224          | 287          | 243          | 254          | 240          | 196          | 178          |
|                              | Non-Member Registration  |              |              |              |              |              |              |              |              |              |              |              |              |
|                              | One-Day  | 60           | 39           | 79           | 44           | 53           | 47           | 59           | 49           | 33           | 38           | 42           | 41           |
|                              | Three-Day  | 5            | 8            | 9            | 10           | 13           | 10           | 8            | 15           | 5            | 12           | 21           | 17           |
|                              | <b>Total Paid</b>  | <b>857</b>   | <b>781</b>   | <b>825</b>   | <b>847</b>   | <b>912</b>   | <b>874</b>   | <b>944</b>   | <b>883</b>   | <b>887</b>   | <b>919</b>   | <b>972</b>   | <b>1088</b>  |
|                              | Speakers, Session Chair, Guests  | 128          | 137          | 132          | 130          | 127          | 122          | 132          | 125          | 136          | 148          | 137          | 161          |
|                              | Students, PSU Personnel, Press   | 68           | 102          | 96           | 71           | 101          | 67           | 100          | 70           | 111          | 106          | 165          | 199          |
|                              | <b>Total Free</b>  | <b>196</b>   | <b>239</b>   | <b>228</b>   | <b>201</b>   | <b>228</b>   | <b>189</b>   | <b>232</b>   | <b>195</b>   | <b>247</b>   | <b>254</b>   | <b>302</b>   | <b>360</b>   |
|                              | <b>Total Paid and Free</b>   | <b>1,053</b> | <b>1,053</b> | <b>1,140</b> | <b>1,140</b> | <b>1,140</b> | <b>1,176</b> | <b>1,176</b> | <b>1,134</b> | <b>1,134</b> | <b>1,274</b> | <b>1,274</b> | <b>1,274</b> |
|                              |  | <b>1,020</b> | <b>1,020</b> | <b>1,048</b> | <b>1,048</b> | <b>1,048</b> | <b>1,063</b> | <b>1,063</b> | <b>1,078</b> | <b>1,078</b> | <b>1,173</b> | <b>1,173</b> | <b>1,448</b> |
|                              | The vegetable grower attendance has increased over the previous year for the past four years. It is readily acknowledged that weather (the Convention is held at the end of January/beginning of February each year) can significantly negatively impact attendance and is an uncontrollable factor that   |              |              |              |              |              |              |              |              |              |              |              |              |

fortunately has not had a negative impact for the past several years. The Association works hard to gather grower input to plan an educational program that draws grower interest and meets their educational needs. The Association also uses its newsletter, email updates and other member communication tools to promote this event to its members and non-member growers. The organizational capacity being addressed by this project is thus an important part of enabling the Association to continue to grow and expand this event as an educational resource for growers. While the goal of reaching a 20% increase in 2015 over 2013/2014, was not reached, this percent increase over 2013/2014 (when paid attendance averaged 885) was achieved 2017 (when paid attendance reached 1,088.)

Membership in PVGA has also grown over the past three years as shown below:

|                 | <u>2017</u>  | <u>2016</u>  | <u>2015</u> | <u>2014</u> | <u>2013</u> | <u>2012</u> | <u>2011</u>  | <u>2010</u> | <u>2009</u> | <u>2008</u> |
|-----------------|--------------|--------------|-------------|-------------|-------------|-------------|--------------|-------------|-------------|-------------|
| <b>Year End</b> | <b>1,063</b> | <b>1,004</b> | <b>993</b>  | <b>974</b>  | <b>962</b>  | <b>988</b>  | <b>1,004</b> | <b>947</b>  | <b>907</b>  | <b>911</b>  |

2. GOAL: Increase visit counts on web-based media platforms.

PERFORMANCE MEASURE: Number of visits.

BENCHMARK: Number of visits recorded in first two months of the project.

TARGET: Monthly average is 10% higher than benchmark.

A major goal of the 2017 social media campaign was to drive more consumers to the PA Veggies website. Google Analytics were employed beginning June 22, 2017. We see a direct correlation between website traffic increases and popular Facebook posts from 2017. Some examples of this include:

- FB post on July 26 with 1,000 reached and 28 interactions resulted in a July 29 spike in website page visits at 229, five times the number of page visits over the average 45/day for late June.
- FB post on August 1 with 943 reached and 35 interactions resulted in an Aug. 1 spike in website page visits at 181, with sustaining page visits for the following 8 days at an average of 137 until another huge increase on Aug. 11.
- FB post on August 11 with 1,400 reached and 93 interactions resulted in an August 11 spike in website page visits at 442, almost 10 times the average number of page visits at 45/day for late June.

Further examination of Google Analytics reveals that overall website page visits and users doubled throughout the course of the PA Produce Month marketing campaign. For the time period between June 22, 2017 (when the analytics were initially used) and July 3, 2017, there was an average of 23 users per day and 45 page visits per day. For the month of August 2017, data shows an average of 50 users per day and 118 page visits per day. This is a clear indication that promotional efforts throughout July and August drove more visitors to the PA Veggies website and increased consumer exposure to PA Produce Month. We feel that our targeted and thorough marketing campaign surpassed the goal of reaching 10% more consumers over 2016.

Unfortunately, website data for the first two months of the project is not available because the proper analytics had not been set up on the website. However, given that the content on the website was much less extensive and not recently updated, and promotion of the website was minimal, we are confident the benchmark was easily exceeded.

3. GOAL: Increase in sales volume for PVMRP growers for 2015.

PERFORMANCE MEASURE: Sales volume as reported by the PVMRP's annual survey.

BENCHMARK: 2014 sales volume, as reported by the PVMRP annual survey.

TARGET: 30% of growers will report a 5% or more increase for 2015 over 2014

Over the past several years, PVMRP has asked growers to report in their annual Grower Survey how their fresh market sales have compared to their previous year's sales. The Program has not asked for actual sales figures (which most growers would likely be reluctant to report and which many growers would not likely have readily available in the fall when the survey is conducted). Rather, growers are asked to use their best judgement to report whether their sales have decreased, remained the same, increased 1 to 5% or increased 5% or more. Growers are also asked if they have made major improvements or changes in their operation that they believe significantly increased their sales (such built new market facilities, attended an additional farmers' market, started a CSA, etc.). The results for the past five years of these survey questions is below:

Compared to the year before, has your sales volume:

|                           | <u>2016</u> | <u>2015</u> | <u>2014</u> | <u>2013</u> | <u>2012</u> |
|---------------------------|-------------|-------------|-------------|-------------|-------------|
| - decreased               | 27%         | 22%         | 18%         | 17%         | 22%         |
| - remained about the same | 40%         | 37%         | 35%         | 35%         | 38%         |
| - increased 1 to 5%       | 19%         | 26%         | 30%         | 23%         | 19%         |
| - increased 5% or more    | 14%         | 15%         | 17%         | 25%         | 21%         |

Did you make major improvements or changes to your operation that you believe significantly increased your sales (built new market facilities, attended an additional farmers market, started a CSA, etc.)

|       | <u>2016</u> | <u>2015</u> | <u>2014</u> | <u>2013</u> | <u>2012</u> |
|-------|-------------|-------------|-------------|-------------|-------------|
| - yes | 10%         | 15%         | 14%         | 16%         | 20%         |

As the results for the past five years above show, the Program has not achieved the goal of 30% of growers reporting a 5% or more increase in sales. In deed, if the percentage of growers that made major improvements or changes is subtracted from the equation, only a few would have actually reported a 5% or more increase in sales. This survey is mailed to 1,300 to 1,500 growers and usually receives more that 200 responses, so it has some credibility in terms of sample size. However it does only ask for the growers' estimate of their sales rather than actual figures. Moreover, many factors in the individual farm operations can significantly impact sales besides area-wide influences like dry/wet weather, so it is impossible to draw definite conclusions. The Program has asked this same question for more than five years and consistently more growers report an increase in sales over the previous years than a decrease – a healthy and necessary characteristic for a thriving industry. The increases are not as high as the goal set however, and it really is impossible to definitively attribute the increase in sales to the PVMRP's promotion activities. There are so many variables that contribute to the increase in sales, simple inflation being one of them.

4. GOAL: Having a working crisis management and public relations plan in place by June 2015

PERFORMANCE MEASURE: Completion of reviewed crisis management and public relations plan.

BENCHMARK: No plan exists in Pennsylvania.

TARGET: Stakeholder reviewed plan for implementation prior to 2015 growing season.

The goal of having a crisis management plan in place prior to the 2015 growing season was not achieved. However, as reported in the Project Approach section, PVGA did hire Watson Green to

|                |  |
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|                | <p>create a crisis management plan for the Association to be able to react to a vegetable industry crisis on behalf of the industry as a whole. They trained the PVGA Executive Committee to act as a Crisis Management Team in a workshop in December 2015. In action, beginning in July 2015, Watson Green provided a series of six articles for the PVGA newsletter to help growers be prepared to deal with a crisis on their own farms, especially a food safety crisis. In January 2016, Watson Green presented at the Mid-Atlantic Fruit and Vegetable Convention as an in-person review of the article series. In January 2017, they presented a Recall Readiness workshop at the Convention. While this Crisis Management Plan is in place, the ongoing effort that was initiated as part of this project to increase the PVGA staff capacity is critical to the Association being able to professionally and effectively carry out the Crisis Management Plan in the event of an actual vegetable industry crisis.</p> <p>5. GOAL: Facilitate certification of non-GAP (Good Agricultural Practices) certified growers and support group-GAP certification efforts.<br/> PERFORMANCE MEASURE: Number of PA growers that have used PVGA materials and assistance to assist them in GAP certification.<br/> BENCHMARK: Currently, no assistance program is available from PVGA.<br/> TARGET: At minimum, 100 growers will receive assistance from PVGA either from workshops or distributed materials.</p> <p>As noted in the Project Summary section, PVGA was not able to implement a low-cost assistance program to help growers achieve GAP certification. The Association did present a workshop on GAP training at the 2015 Mid-Atlantic Fruit and Vegetable Convention attended by 67 persons. Part of the dynamic in this area was the delay in the finalization of the Produce Rule required under the Food Safety Modernization Act (FSMA) until November 2015. While the FSMA Produce Rule does not entirely replace GAP certification, any good GAP training would have to include the provisions of the Produce Rule since they would be federal law. Once the Produce Rule was finalized, there was further delay until the Produce Safety Alliance developed the curriculum for the required FSMA grower training. This curriculum was finalized in late 2016. In January 2016, the Association presented a workshop entitled Tools for Farm Food Safety Planning, GAP Audits and FSMA Compliance at the Mid-Atlantic Fruit and Vegetable Convention attended by about 30 persons. When the curriculum for the for required FSMA training was completed in late 2016, one of the first grower training sessions in the state was presented at the 2017 Mid-Atlantic Convention with 50 persons in attendance. More growers expressed interest but the presenters from Penn State Extension wanted to limit the workshop size to 50 persons to facilitate personal interaction between instructors and participants. The Association has also published numerous food safety/GAP articles in its monthly newsletter and sponsored several mock GAP audit twilight meetings conducted by Penn State Extension. So while no formal assistance program is in place, the Association is engaged in providing training opportunities for growers.</p> |
| Beneficiaries: | <p>The primary beneficiaries are Pennsylvania’s vegetable growers. Secondary beneficiaries include the PVGA and the PVMRP and all the industry stakeholders who benefit from a profitable vegetable industry, a strong trade organization and a healthy marketing &amp; research program including supporting industries such as processors and distributors; educators and researchers; and ultimately consumers.</p> <p>It is very difficult to count the number but it is estimated there are in excess of 3,500 growers of vegetables at some commercial level in Pennsylvania. PVGA membership has grown to just over 1,000 over the course of the project.</p>   |



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|                         | <p>In any given year, PVGA and the PVMRP program provide funding grants totaling \$50,000 to \$80,000 to 10 to 17 research programs at Penn State and other institutions including Penn State Extension.</p> <p>It is not possible to estimate the number of Pennsylvania residents who enjoy seasonal vegetables grown in the state on an annual basis. Part of this project was aimed at making Pennsylvania consumers more aware of the availability of fresh, local produce on timely basis using press relations and social media.</p> <p>The project has contributed to the long-term sustainability of the organizations and long term viability of the industry by creating a dynamic interface between the organizations and their stakeholders in order to reflect changes in the landscape and continuously meet their needs and expectations in the near, medium and long term.</p> <p>The potential economic impact is multiple. A viable and growing vegetable industry in the state is a boost to the state’s agricultural economy and therefore to the state’s rural economy although the dollar amount of this impact is not able to estimated.</p>   |
| <p>Lessons Learned:</p> | <p><b>1. Produce Month</b><br/> PVMRP has worked with KTC, an knowledgeable and experienced agricultural marketing consultant, to carry out an enhanced “August is Pennsylvania Produce Month” with press relations and social media components. The goal was to put increased resources into the August promotion that previously were devoted to a season-long press relations campaign and vegetable recipe contest. This was the recommendation of Jeff Manning, a marketing consultant hired with a state grant to evaluate the Program’s promotion’s efforts. However, with the addition of social media to the August promotion, it seems that it is logical and feasible to extend both the press relations effort and the social media campaign beyond August to encompass more of the Pennsylvania vegetable marketing season.</p> <p>For close to ten years, Program staff (an independent contractor with clerical help) has conducted the Program’s promotional efforts. While that was a cost effective alternative to hiring outside advertising/marketing firms which was the practice in the early years of the Program, the hiring of KTC has allowed the program to include new, fresh approaches into its promotion efforts from marketing professionals.</p> <p><b>2. Public Relations and Crisis Management</b><br/> As noted in the Goals and Outcomes Achieved section, the development of a crisis management plan is an important first step for the Association and the industry. However, given the current limited staff capacity of the Association, implementing the plan in an actual crisis would be challenging. The ongoing effort of the Association to increase its staff capacity will be an important step in enabling the Association to meet that challenge. The Association did face a grower relations crisis in February 2017 following a controversial keynote speaker at the 2017 Mid-Atlantic Fruit and Vegetable Convention. Several attendees expressed very strong negative reactions to the speaker although many others appreciated the speakers viewpoints. The staff did review the crisis management plan as the situation developed but in the end it was determined it would be best not to over react to the situation and create more of an issue than necessary. In the end, the Association did issue at statement to the members emphasizing that the positions presented by speakers at the Convention are those of the speaker and not necessarily endorsed by the Convention or the Association.</p> <p><b>3. Business Development Plan</b></p> |

Pennsylvania Department of Agriculture – FY2014 Specialty Crop Block Grant

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|                    | <p>The most important lesson learned is that while strategic plans and planning are and should be part of any organization's business plan, implementing the aspirations and goals of such plans can often be a major stumbling block in realizing any value from the exercise. Strategic planning is only one dimension of an overall holistic approach to implementation and realization – the identification and implications of other factors must be recognized and considered. In the case of the Pennsylvania Vegetable Growers Association, a very rigorous statewide effort put together a powerful Strategic Plan for the industry in 2014 with the input of multiple stakeholders. It took a second step to fully understand the capacity requirements to envision a practical approach to operationalizing that plan. It will take a third step to fund and build the necessary capacity to implement it.</p>  |
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| <b>Project 16</b>  | <b>Education Assistance Program for Specialty Crops Growers</b>  |
| Project Summary:   | <p>Any successful business is established through good planning and attention to the changing needs of the business itself, the family(ies) it supports and the customers it serves. This is especially true for the specialty crop industry which must address growing food safety needs such as GAP/GHP, new FSMA regulations, plan for changes in input costs, deal with the growing trend of local food and the benefits (direct sales, diversified income) and challenges (public access on farm, increased liability), operate financially in a much more risk adverse lending atmosphere etc. Through this grant, the PAgrows program provides effective and timely access to educational opportunities that cover business planning and financial management skills, especially for young and beginning farmers.</p>   |
| Project Approach:  | <p>At the completion of the grant, 43 specialty crops growers, prioritized to young and beginning, received scholarship funding with an average scholarship amount per applicant of \$283 to attend a program such as but not limited to educational workshops, seminars, incubator programs and certificate programs. Organizations, such as AgChoice Farm Credit, running these programs, mainly the AgBiz Masters Program, submitted an application to the PAgrows program coordinator to determine if the program is eligible to participate. Once approved the organization running the program, with support from the Department of Agriculture, was responsible for advertising the opportunity to potential applicants and meeting any requirements for reimbursement through PAgrows. Surveys were used to evaluate attendees' knowledge and skill gains, potential for implementation of what was learned and general assessment of the program they attended.</p> <p>Educational presentations were held at Ag Progress Days regarding specialty crops and were organized by AgChoice Farm Credit as part of the AgBiz Masters Program. During these presentations, recognition was given to specialty crop producers who completed the AgBiz Masters program and received scholarship funding.</p> |
| Goals and Outcomes | <p>It was the goal of PAgrows and the Pennsylvania Department of Agriculture to increase both attendance and access to educational opportunities for specialty crop producers. Additionally,</p>   |

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| Achieved:         | <p>there was a focus on increasing the knowledge of and application of relevant skill areas such as business skills, finance and lending principals, regulatory requirements, and management skills.</p> <p>100 specialty crop growers were projected to participate in programs with an average cost per applicant of \$300. Actual participation was 35 specialty crop growers with an average of \$122 in scholarship funding received per student.</p> <p>Surveys were distributed, collected, and tallied to capture feedback from participants in the AgBiz Masters Program. In the approved state plan, a target of 80% was established that would show specialty crop growers would report that their knowledge or skills have increased because of the educational opportunity. Responses indicate that over 90% of participants had a positive experience. Another target was established at 70% of the specialty crop growers participating would plan to implement the increased knowledge on their farming operation. Responses indicate that 100% of the participants will likely use the information obtained through the program on their operation. At the conclusion of the first year, over 50% of participants had begun to write a business plan for their operation, while nearly 75% of the participants rated the quality of year 2 workshops as “Excellent”. Comments provided by the participants indicate the desire for continuing education in the areas of business and financial planning, as well as transition assistance.</p> |
| Beneficiaries:    | 35 specialty crop growers completed the AgBiz Masters program and received scholarship funding. The skills and knowledge gained from the completion of the program will have a positive impact on the growers’ operation, and therefore creating a positive economic impact on Pennsylvania’s agricultural economy.   |
| Lessons Learned:  | Total participation fell short of expectations; this was partially due to other scholarship and funding sources becoming available to specialty crop growers. Increased marketing and outreach efforts to specialty crop growers will continue to aid in bolstering enrollment for the AgBiz Masters Program.   |
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|                   |   |
| <b>Project 17</b> | <b>Improved Management of Onion Bacterial Diseases through Increased Understanding of Pathogens Epidemiology and Research Based Management Strategies</b>   |
| Project Summary:  | <p>Year after year, onion growers in Pennsylvania are challenged by in-field and post-harvest yield losses due to several bacterial diseases. In PA, the majority of sweet onions grown are marketed through the PA Simply Sweet Onion Program, the state’s only trademarked crop. These onions are intensively grown on black plastic mulch in four rows at 6-in. x 6-in. spacing on beds that are 3 ft wide with a double row of drip irrigation. Fields typically range from 0.5 to 1.5 A in size. Since the program’s inception in 2002, acreage has quadrupled and in 2016 approx. 124 A were planted with 6.8 million transplants with an estimated crop value of \$1.45 million (72,550 (40 lb) boxes/A at \$20/box). In 2013, losses due to bacterial diseases reduced</p>  |

the number of marketable boxes over 40% leading to a total loss of \$488,000 (or \$4,480/A) and many growers did not financially break even. These losses are often compounded by additional losses post-harvest since center rot often affects only a single internal scale while, the outer scales remain firm leaving the disease virtually impossible to detect. Center rot is caused by *Pantoea agglomerans* and *Pantoea ananatis*, however, several other bacterial species may also cause soft rots and/or surface rots that initiate in the outer most scale and work inward. These pathogens include *Pectobacterium carotovorum* and *Pseudomonas marginalis* as well as *Burkholderia cepacia* and *B. gladioli*; the latter two are observed less frequently in PA. Despite these production challenges, the potential high economic returns due to increasing market demand drive continued grower interest in onion production.

Initial funding from the PA Vegetable Growers Association and Simply Sweet Onion program enabled us to identify the primary complex of bacterial pathogens involved and begin to evaluate potential management strategies. Currently, growers rely on copper-based fungicides and harvesting early to avoid bacterial disease, which sacrifices bulb size but may ensure more marketable (albeit smaller) bulbs. Additional funding was leveraged from the Northeast Regional IPM Competitive Grant program to conduct a two-year study in 2011 and 2012 to identify environmental and production factors related to increased losses in commercial fields by establishing observational survey plots on 30 farms statewide each year. Disease losses tend to be variable both between and among fields, so this approach enabled us to generate large data sets from a range of sites to understand relationships between production and environmental factors that were associated with bacterial disease losses. Soil, onion transplant, and weed samples were also collected to identify potential sources of bacterial inoculum. Now, the next step was to develop more targeted research-based management tools as well as augment current recommendations based on identified relationships and sources of inoculum, in an effort to reduce both at-harvest and post-harvest losses due to bacterial diseases.

The **overall goal** of this project was to improve the management of bacterial diseases of onion through the development of integrated and targeted research-based management strategies that will increase the number of tools available to growers and ultimately reduce harvest and post-harvest losses. This will be accomplished through the following objectives:

1. **Evaluate the efficacy of using treatments to manage populations of bacterial pathogens of onion known to colonize the surface of onion transplants.** Previous research in PA has demonstrated that bacterial pathogens that cause bulb rots may be associated with the surface of out-of-state sourced bare-root as well as locally grown transplants. Eliminating the bacteria prior to planting through use of a transplant dip/drench would reduce a potential source of the bacterial pathogens and provide growers with another disease management tool.
2. **Evaluate the application timing and reduced nitrogen rates (total broadcast and fertigation) on marketable yield and bacterial disease incidence.** Preliminary data has indicated that applying the total crop nitrogen required (regardless of source) prior to onion bulbing increased total yield and may reduce disease losses. Extensive on-farm survey data has indicated that there is a relationship between leaf tissue nitrogen at mid-

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|                          | <p>season and increased losses from bacterial rots at harvest. Prior interest in the impact of fertility on bacterial disease management has also been expressed by growers.</p> <p>3. <b>Evaluate the susceptibility of onion cultivars to center rot, the most common bacterial disease affecting onion in PA.</b> Host resistance is one of the most important tools available for disease management. Onion cv. Candy, the most common cultivar grown in the Simply Sweet Onion Marketing Program, is very susceptible based on continued commercial losses. Identification of less susceptible cultivars that meet the marketing program criteria would provide growers with another management tool. No location-specific trials have been conducted to-date. At harvest the onions will also be evaluated for size, pungency and soluble solids to make sure they meet the requirements of the Simply Sweet Program.</p> <p>4. <b>Develop scouting guidelines and establish visual disease thresholds to aid growers in harvest timing decisions in fields under pressure from bacterial diseases.</b> Current commercial production practices call for pulling and field curing onions for two or three days before being topped, placed in bins and further dried down passively or actively with fans. Depending on the stage of maturity and diameter of the neck, this may or may not adequately dry onion necks down enough to restrict movement of the bacteria from the leaves to the bulbs. Timing harvest based on symptom thresholds will provide growers with a harvest guideline to minimize bacterial movement into the bulb, thus helping to reduce losses in storage.</p>   |
| <p>Project Approach:</p> | <p><b>PROJECT APPROACH:</b></p> <p><b>Objective 1: Evaluate the efficacy of using treatments to manage populations of bacterial pathogens of onion known to colonize the surface of onion transplants.</b></p> <p>The efficacy of select pre-plant transplant treatments was evaluated in both culture-based <i>in-vitro</i> and transplant assays. The products evaluated included OxiDate (hydrogen dioxide, BioSafe Systems, Glastonbury, CT), OxiPhos (hydrogen peroxide with mono- and di-potassium salts of phosphorus acid, BioSafe Systems, Hartford, CT), FireWall 17WP (streptomycin sulfate, AgroSource, Mountainside, NJ), MasterCop (copper sulfate pentahydrate, ADAMA, Raleigh, NC) and Actinovate (<i>Streptomyces lydicus</i>, Novozymes BioAg, Brookfield, WI).</p> <p>For the <i>in-vitro</i> assay, products were evaluated in a 96-deep well plate. Two milliliters of product-amended or non-amended LB media was dispensed into its respective wells and then each well inoculated with 10 µL of 10<sup>4</sup> CFU/mL of each isolate was transferred into its corresponding well using a multichannel pipette. Five <i>P. agglomerans</i> isolates and three <i>P. ananatis</i> isolates were evaluated individually. These isolates had previously been shown to induce disease in pathogenicity tests. Each product was evaluated at four different concentrations including 100, 75, 50 and 25% of the product label rate. For some products, lower dilutions were also evaluated. After all wells had been inoculated, plates were placed in an orbital shaker at 150 rpm for 1 min to mix treatments prior to taking the time 0 hour reading. After time 0 hour samples were collected, the plates maintained at 30°C, in an orbital shaker at 150 rpm. A measurement of optical density (OD), which served as the proxy for bacterial growth, was taken using an ELISA microplate reader (Falcon®, Corning Incorporated</p> |

Tewksbury, MA, USA) at time 0 and then again at 12, 24, 36 and 48 h intervals. The higher the OD reading the more bacterial growth occurred indicating that the product at that concentration was not as effective at reducing the bacterial population. Within each plate each treatment was replicated three times and the entire assay was repeated at least two times per product. For the *in-vitro* plate assay, changes in optical density over time were evaluated using proc mixed repeated measures SAS 9.4 (SAS Institute, Cary, NC). Optical density did not vary by isolate or experiment so data were pooled and the mean value was used for analysis, except for the Actinovate treatment data. The autoregressive covariance structure ar (1) was used for this analysis since it had the lowest Akaike's Information Criteria (AIC) and Bayesian Information Criteria (BIC) values compared to other covariance structures.

For the **transplant assay**, bare-root transplant cv. Candy were sourced from Sunbelt Transplant Inc. in Buckeye, AZ. The transplant treatments were as follows: 1) negative control (70% EtOH surface sterilized); 2) positive control (70% EtOH surface sterilized + inoculated); 3) OxiDate; 4) OxiPhos; 5) Firewall; 6) Actinovate; 7) MasterCop. All products were applied at the 100% label rate. On day 0, all plants were treated with 70% EtOH to surface sterilize the transplants and then once dry a bacterial inoculum mix of one *P. ananatis* and one *P. agglomerans* isolate (between  $3.1 \times 10^8$  and  $6.2 \times 10^8$  CFU/ml) was applied. On day 2, bundles of three transplants were treated with one of the products for a total of 21 bundles per treatment times four replications. Until processing, the bundles of three plants were maintained in sterile glass culture tubes that contained 4 mL sterile MQ H<sub>2</sub>O placed in culture tube racks kept at room temperature (21°C) under ambient light. Each day of the assay (day 0 to 7), one bundle of 3 plants per treatment was destructively sampled and the bacterial population on the surface of the transplants serial diluted on KB media and maintained at 21°C until the number of bacterial colonies counted approximately 36 to 48 h after plating. Transplant CFU/mL data were analyzed using proc mixed in SAS 9.4 and a one-way ANOVA in Minitab 17.3 (Minitab, State College, PA, USA), in addition to post-hoc mean comparisons using Tukey's HSD ( $\alpha = 0.05$ ).

**Objective 1 Results and Discussion.** OxiDate, OxiPhos, Firewall and MasterCop all had significantly lower optical densities (*in-vitro* assay) and CFUs/mL (transplant assay) compared to the bacterial only control and show promise as transplant treatments for reducing epiphytic pathogen populations thus reducing a potential inoculum source and contributing to the management of onion center rot (Table 1; Table 2). OxiDate and Actinovate AG are Organic Materials Review Institute (OMRI) approved products and can be used in certified organic production. Some copper products are OMRI approved, although MasterCop specifically is not. Therefore some of the options explored here may be potential center rot management strategies for organic growers. Of the products screened in this study, FireWall had the lowest CFU/mL at all time points and a consistently low optical density. Although some of the products like OxiPhos and OxiDate performed well at concentrations as low as 5% of the label rate, FireWall did not (Table 2). MasterCop at its lowest concentration of 25% also had high optical density values just under the positive control, indicating that *P. agglomerans* and *P. ananatis* growth was not inhibited at this concentration. Perhaps at low concentrations of FireWall and MasterCop, there is not enough active ingredient for the product to effectively reduce populations of *P. agglomerans* and *P. ananatis*.

**Table 1.** Means comparison of optical density from product amended media. Each data point represents a mean of two or more experiments, eight bacterial isolates and three replicates (n=135 for OxiDate, OxiPhos and FireWall; n=90 for MasterCop and Actinovate). Data was analyzed separately by each time point and product treatment using a one-way ANOVA in Minitab and letters indicate statistically significant differences by Tukey's HSD ( $\alpha = 0.05$ ).

| Treatment              | Time (h)        |                 |                 |                 |                 |
|------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                        | 0               | 12              | 24              | 36              | 48              |
| Water only control     | 0.053 a         | 0.052 b         | 0.053 b         | 0.054 b         | 0.055 b         |
| 100% OxiDate           | 0.043 c         | 0.041 d         | 0.042 b         | 0.042 b         | 0.041 b         |
| 75% OxiDate            | 0.044 c         | 0.041 d         | 0.041 b         | 0.042 b         | 0.042 b         |
| 50% OxiDate            | 0.043 c         | 0.042 d         | 0.043 b         | 0.044 b         | 0.042 b         |
| 25% OxiDate            | 0.048 b         | 0.046 c         | 0.046 b         | 0.046 b         | 0.045 b         |
| 15% OxiDate            | 0.051 ab        | 0.048 c         | 0.048 b         | 0.049 b         | 0.047 b         |
| 10% OxiDate            | 0.054 a         | 0.053 ab        | 0.053 b         | 0.050 b         | 0.049 b         |
| 5% OxiDate             | 0.053 a         | 0.053 ab        | 0.054 b         | 0.054 b         | 0.052 b         |
| Bacterial only control | 0.053 a         | 0.055 a         | 0.336 a         | 0.564 a         | 0.685 a         |
|                        | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> |
| Water only control     | 0.052 a         | 0.054 b         | 0.055 b         | 0.053 b         | 0.052 b         |
| 100% OxiPhos           | 0.047 e         | 0.043 f         | 0.040 b         | 0.041 b         | 0.042 b         |
| 75% OxiPhos            | 0.043 e         | 0.043 f         | 0.041 b         | 0.041 b         | 0.043 b         |
| 50% OxiPhos            | 0.044 de        | 0.044 ef        | 0.045 b         | 0.043 b         | 0.042 b         |
| 25% OxiPhos            | 0.046 cd        | 0.047 de        | 0.049 b         | 0.046 b         | 0.045 b         |
| 15% OxiPhos            | 0.049 bc        | 0.050 cd        | 0.050 b         | 0.046 b         | 0.048 b         |
| 10% OxiPhos            | 0.051 ab        | 0.052 bc        | 0.050 b         | 0.052 b         | 0.049 b         |
| 5% OxiPhos             | 0.051 ab        | 0.053 bc        | 0.052 b         | 0.052 b         | 0.052 b         |
| Bacterial only control | 0.054 a         | 0.057 a         | 0.338 a         | 0.563 a         | 0.745 a         |
|                        | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> |
| Water only control     | 0.052 f         | 0.052 d         | 0.054 c         | 0.053 d         | 0.056 c         |
| 100% FireWall          | 0.073 ab        | 0.068 a         | 0.074 bc        | 0.102 b         | 0.059 c         |
| 75% FireWall           | 0.077 a         | 0.067 ab        | 0.069 bc        | 0.101 b         | 0.058 c         |
| 50% FireWall           | 0.064 cd        | 0.065 ab        | 0.064 c         | 0.066 bcd       | 0.055 c         |
| 25% FireWall           | 0.061 d         | 0.062 ab        | 0.072 bc        | 0.064 cd        | 0.061 bc        |
| 15% FireWall           | 0.068 bc        | 0.067 ab        | 0.106 b         | 0.071 bcd       | 0.068 bc        |
| 10% FireWall           | 0.058 de        | 0.061 bc        | 0.059 c         | 0.064 bcd       | 0.060 bc        |
| 5% FireWall            | 0.059 d         | 0.060 bc        | 0.062 c         | 0.095 bc        | 0.118 b         |
| Bacterial only control | 0.053 ef        | 0.056 c         | 0.345 a         | 0.538 a         | 0.668 a         |
|                        | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> |

**Table 1. Continued**

| Treatment                    | Time (h)        |                 |                 |                 |                 |
|------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
|                              | 0               | 12              | 24              | 36              | 48              |
| Water only control           | 0.057 e         | 0.057 d         | 0.058 e         | 0.058 f         | 0.058 e         |
| 100% MasterCop               | 0.314 a         | 0.375 a         | 0.205 c         | 0.347 c         | 0.210 d         |
| 75% MasterCop                | 0.243 b         | 0.226 b         | 0.189 c         | 0.248 d         | 0.180 d         |
| 50% MasterCop                | 0.175 cd        | 0.198 b         | 0.137 d         | 0.189 e         | 0.265 c         |
| 25% MasterCop                | 0.127 d         | 0.140 c         | 0.263 b         | 0.470 b         | 0.512 b         |
| Bacterial only control       | 0.056 e         | 0.062 d         | 0.384 a         | 0.583 a         | 0.714 a         |
|                              | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> |
| Water only control           | 0.054 a         | 0.052 c         | 0.052 b         | 0.052 c         | 0.057 c         |
| 100% Actinovate non-filtered | 0.055 a         | 0.071 ab        | 0.220 a         | 0.297 b         | 0.338 b         |
| 75% Actinovate non-filtered  | 0.057 a         | 0.073 a         | 0.215 a         | 0.285 b         | 0.369 b         |
| 50% Actinovate non-filtered  | 0.054 a         | 0.067 ab        | 0.218 a         | 0.282 b         | 0.342 b         |
| 25% Actinovate non-filtered  | 0.054 a         | 0.065 b         | 0.207 a         | 0.249 b         | 0.308 b         |
| Bacterial only control       | 0.057 a         | 0.052 c         | 0.201 a         | 0.402 a         | 0.564 a         |
|                              | <u>P=0.352</u>  | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> |
| Water only control           | 0.052 a         | 0.057 b         | 0.055 c         | 0.057 b         | 0.054 c         |
| 100% Actinovate filtered     | 0.051 a         | 0.063 a         | 0.257 ab        | 0.484 a         | 0.309 b         |
| 75% Actinovate filtered      | 0.052 a         | 0.057 ab        | 0.233 b         | 0.440 a         | 0.257 b         |
| 50% Actinovate filtered      | 0.052 a         | 0.058 ab        | 0.254 ab        | 0.504 a         | 0.599 a         |
| 25% Actinovate filtered      | 0.052 a         | 0.059 ab        | 0.278 a         | 0.479 a         | 0.560 a         |
| Bacterial only control       | 0.052 a         | 0.057 ab        | 0.244 ab        | 0.454 a         | 0.583 a         |
|                              | <u>P=0.910</u>  | <u>P=0.059</u>  | <u>P≤0.0001</u> | <u>P≤0.0001</u> | <u>P≤0.0001</u> |

**Table 2.** Means comparison of epiphytic CFUs/mL from product treated transplants. Three plants per treatment replicate were destructively harvested and epiphytic wash was plated for CFU/mL assessment. Each data point represents a mean of two experiments and four replicates (n=8). Data was analyzed by a one-way ANOVA in Minitab and different letters within each column indicate statistically significant differences by Tukey's HSD ( $\alpha = 0.05$ ).

| Treatment | Day       |           |         |         |           |           |
|-----------|-----------|-----------|---------|---------|-----------|-----------|
|           | 2         | 3         | 4       | 5       | 6         | 7         |
| FireWall  | 1.5E+06 b | 1.3E+06 b | 3.2E+06 | 4.0E+06 | 7.5E+05 b | 2.7E+06 b |



|                       |                       |            |         |         |                        |            |
|-----------------------|-----------------------|------------|---------|---------|------------------------|------------|
| Water only control    | 4.7E+0 <sub>6</sub> b | 4.7E+06 b  | 1.1E+07 | 6.3E+06 | 5.1E+0 <sub>6</sub> ab | 9.9E+06 ab |
| OxiPhos               | 5.5E+0 <sub>6</sub> b | 1.1E+07 ab | 1.2E+07 | 1.1E+07 | 6.8E+0 <sub>6</sub> ab | 3.1E+07 ab |
| MasterCop             | 6.0E+0 <sub>6</sub> b | 6.2E+06 ab | 5.3E+06 | 6.3E+06 | 9.1E+0 <sub>6</sub> a  | 1.5E+07 ab |
| OxiDate               | 1.1E+0 <sub>7</sub> b | 1.2E+07 ab | 1.4E+07 | 6.7E+06 | 3.7E+0 <sub>6</sub> ab | 1.1E+07 ab |
| Actinovate            | 2.4E+0 <sub>7</sub> a | 7.9E+06 ab | 1.9E+07 | 1.7E+07 | 2.0E+0 <sub>6</sub> ab | 4.5E+07 a  |
| Bacteria only control | 4.2E+0 <sub>7</sub> a | 2.4E+07 a  | 1.1E+07 | 3.9E+07 | 4.6E+0 <sub>6</sub> ab | 1.5E+07 ab |
|                       | P≤0.0001              | P=0.017    | P=0.347 | P=0.069 | P=0.028                | P=0.028    |

**Objective 2: Evaluate the application timing and reduced nitrogen rates (total broadcast and fertigation) on marketable yield and bacterial disease incidence.**

A total of three field trials were conducted on a Hagerstown silt loam soil in 2015 and 2016 to evaluate the effect of nitrogen application timing and rate on marketable yield and center rot incidence. Bare-root, onion transplants, cv. Candy (Dixondale Farms, Carrizo Springs, TX in 2015 and Sunbelt Transplant Inc., Buckeye, AZ in 2016), were planted at the Penn State Russell E. Larson Agricultural Research Center in PA Furnace, PA (Rock Springs) on May 4, 2015 and April 19-20, 2016 and the Penn State Southeast Agricultural Research and Extension Center in Manheim, PA (Landisville) on April 13, 2016. Based on a soil test and following standard commercial production practices, soil nutrient levels other than N were adjusted according to commercial crop recommendations prior to planting based on a composite soil nutrient test (Penn State Agricultural Analytical Services Lab, University Park, PA). Onions were grown using standard black plastic mulch with a double row of drip irrigation. At planting, composite soil samples consisting of approximately 15 cores were collected from each trial across the entire field using a soil probe 1.0 in. in diameter to a depth of 6.0 in. and homogenized by hand. Samples were analyzed by the Penn State Agricultural Analytical Services Lab for total % N combustion.

Liquid urea ammonium nitrate fertilizer (UAN, 30-0-0, sourced from Growmark, Pleasant Gap, PA) amended with Agrotain® Ultra 1.67 mL/L (1 qt /150 gal H<sub>2</sub>O, Koch Agronomic Services, Wichita, KS), nitrogen stabilizer, was applied weekly through a fertigation system. The whole plot was the timing of N application either half-season (six week duration until bulbing) or full season (10 week duration until harvest). Within each whole plot, all N rate treatments (sub-plot)



**Fig. 1.** Modified fertigation system used in 2016 field trials.

were arranged in a randomized complete block design and replicated four times. The N rate treatments consisted of the following: 1) high rate of 160 lb/A, 2) recommended commercial production rate of 105 lb/A, 3) reduced rate of 50 lb/A, and 4) water only control. A subset of plants in each sub-plot was toothpick inoculated with a mix of *P. ananatis* and *P. agglomerans* isolates (between  $6.2 \times 10^8$  and  $2.6 \times 10^9$  CFU/ml) and included as the sub-sub plot (inoculation proximity). Each sub-plot was 40 ft long and approximately 3 ft wide across the top of the raised bed. Onions were planted four rows wide at the standard 6 in. spacing within and across the rows. In 2015, a Dosatron® (Clearwater, FL) set to 64:1 was used to apply N treatments diluted in 3.8 L H<sub>2</sub>O into the drip irrigation system. In 2016, a modified fertigation system (Fig. 1) was used to apply the N treatments diluted in 1.9 L H<sub>2</sub>O starting the second week of fertilization. Pressure was maintained between 12 to 15 psi while applying treatments. Orifices were plumbed into the system after week three to reduce the flow rate of the fertilizer and ensure even distribution of fertilizer. Each treatment plot could be individually controlled through the use of multiple rows of head tape and shut-off valves.

Composite foliar nitrogen samples were collected from uninoculated sub-plots at four or five time points throughout the season and analyzed for %N at the Penn State Agricultural Analytics Lab. These were timed to represent early-, mid-season, bulb initiation and late-season foliar N content. In addition, horticultural measurements including bulb diameter at its widest point and neck diameter were recorded for five representative onions from each sub-sub plot totaling 15 onion plants per replicate plot. Starting in mid-June through harvest, 10 plants per sub-plot were selected at random to evaluate for weekly disease severity post-inoculation. Disease severity was rated on a 0 to 7 visual disease scale of 0 = no lesion, asymptomatic; 1 = local lesion, < 1-in.<sup>2</sup>; 2 = expanded lesion, but less than ¼ of leaf; 3 = up to ½ of the inoculated leaf is chlorotic or bleached; 4 = more than ½ of the inoculated leaf is chlorotic or bleached, but uninoculated leaves do not show symptoms; 5 = entire inoculated leaf and a portion of an uninoculated leaf are symptomatic; 6 = multiple fully symptomatic leaves; 7 = ≥50% bleached and/or collapsed leaves. At harvest, sub-sub plots were harvested individually. Plots were harvested individually by sub-plot (inoculation proximity). The number and total weight of bulbs with center rot (onions with symptomatic neck scales) symptoms were recorded, and marketable and unmarketable bulbs were graded by size: small, < 2.5 in. in diameter; medium, 2.5 to 2.9 in.; jumbo, 3.0 to 4.0 in.; colossal, > 4.0 in. and weighed by size class.

Data were analyzed using the one-way analysis of variance procedure in Minitab 17.2 (Minitab Inc., State College, PA). ANOVA with two or more factors were analyzed in SAS 9.4 (SAS Institute, Cary, NC). Center rot incidence was square root transformed in ANOVA to satisfy the assumption of normality. Post-hoc comparisons were completed using Tukey's HSD,  $\alpha = 0.05$ . Using the General Linear Model procedure, fertilizer timing, fertilizer rate, inoculation proximity and block (replicate) were input as class variables and block was labeled as random. Comparisons of severity distributions were conducted using the Kruskal-Wallis test in Minitab. Multiple linear regression was performed using the stepwise addition procedure with center rot incidence at harvest (%) analyzed as the dependent variable, which was the total split-plot incidence.

**Objective 2 Results and Discussion.** Total soil % N was 0.10 at Rock Springs in 2015, 0.12 at Rock Springs in 2016 and 0.11 at Landisville in 2016. Neck and bulb diameters were consistently influenced by N rate at all evaluation dates ( $P \leq 0.05$ ) in all three trials, except for at the first evaluation date in Landisville and in 2016 Rock Springs early-season neck diameter only. A significant interaction ( $P \leq 0.05$ ) between rate and time occurred for the mid- and late season neck and bulb diameters in the 2015 Rock Springs trial as well as in 2016 Landisville trial except for the late season neck diameter. Also the 50, 105 and 160 lb N/A rates did not significantly affect late-season neck or bulb diameters.

Median foliar disease assessment ratings ranged between 0 and 4 depending on the N rate in Landisville and the N application rate was significant on all disease assessment dates ( $P=0.004$ ;  $P=0.009$ ;  $P \leq 0.0001$ ). Foliar disease assessment at harvest was significant by inoculation proximity (sub-sub plot) in all three trials ( $P \leq 0.0001$  for Landisville and 2016 Rock Springs;  $P=0.042$  for 2015 Rock Springs). Within each N application rate at Landisville, median disease severity ratings decreased as distance from the inoculated sub-sub plots increased. All rates had median ratings of 5 and 6 for inoculated sub-sub plots, all rates except for the control had median ratings of 4 for adjacent sub-sub plots and the 105 and 160 lb N/A had median ratings of 4 for the uninoculated sub-sub plots. A similar rate affect was present in the inoculated sub-sub plots of the 2016 Rock Springs trial where the 105 lb N/A had a median severity of 3 and rate 160 lb N/A had a median severity of 4 by the final rating assessment date. Within nitrogen rate, inoculation proximity did not affect the median foliar disease severity rating in the 2015 Rock Springs trial.

Center rot incidence in sub-sub plots (inoculation proximity) at harvest ranged from 0 to 11.1% in 2016 Rock Springs, 0 to 22.8% in 2015 Rock Springs and 4.8 to 72.6% in Landisville trials. Surface rot incidence in sub-sub plots at harvest ranged from 0 to 5.3% in 2016 Rock Springs, 0 to 22.1% in 2016 Landisville and 0 to 4.7% in 2015 Rock Springs trials. Center rot incidence at harvest was significantly different by field trial location ( $P \leq 0.0001$ ) with Landisville having significantly higher disease incidence than both Rock Springs trials. In 2016, inoculation proximity was highly significant in determining center rot incidence and there was a significant interaction between N rate and timing of N application (Table 3). In 2015, only N rate significantly affected center rot incidence ( $P \leq 0.0001$ ) (Table 3). When sub-plots were split by inoculation proximity, the significant interaction between rate and time persisted when adjacent and uninoculated sub-sub plots were pooled ( $P=0.0004$  for 2016 Rock Springs and  $P=0.0019$  for Landisville). However, this interaction did not exist when evaluating the inoculated sub-sub plots in either trial and only rate was significant in the Rock Springs 2016 trial ( $P=0.046$ ).

**Table 3.** Center rot incidence by factor (n=96) for all three trials. Data was analyzed by sub-sub plot. Values were square root transformed prior to analysis. Using the General Linear Model procedure, fertilizer timing, fertilizer rate, inoculation proximity and block (replicate) were input as class variables and block was labeled as random.

#### 2015 Rock Springs Trial

| Factor                          | df | F value | P-value |
|---------------------------------|----|---------|---------|
| rate                            | 3  | 15.47   | ≤0.0001 |
| time                            | 1  | 2.07    | 0.1543  |
| inoculation proximity           | 2  | 1.04    | 0.3587  |
| replicate                       | 3  | 15.54   | ≤0.0001 |
| rate*time                       | 3  | 0.73    | 0.5402  |
| rate*inoculation proximity      | 6  | 1.26    | 0.2868  |
| time*inoculation proximity      | 2  | 1.32    | 0.2728  |
| rate*time*inoculation proximity | 6  | 0.17    | 0.9838  |

#### 2016 Rock Springs Trial

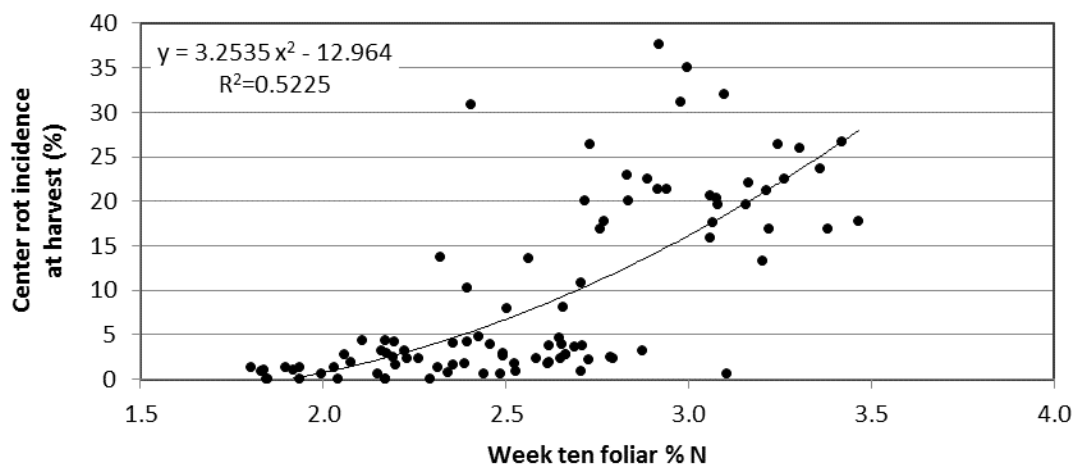
| Factor                          | df | F value | P-value |
|---------------------------------|----|---------|---------|
| rate                            | 3  | 4.04    | 0.0105  |
| time                            | 1  | 1.69    | 0.1973  |
| inoculation proximity           | 2  | 25.42   | ≤0.0001 |
| replicate                       | 3  | 0.57    | 0.6349  |
| rate*time                       | 3  | 2.97    | 0.0376  |
| rate*inoculation proximity      | 6  | 0.79    | 0.5815  |
| time*inoculation proximity      | 2  | 0.02    | 0.9826  |
| rate*time*inoculation proximity | 6  | 2.09    | 0.0652  |

#### 2016 Landisville Trial

| Factor                          | df | F value | P-value |
|---------------------------------|----|---------|---------|
| rate                            | 3  | 0.36    | 0.7813  |
| time                            | 1  | 0.55    | 0.4597  |
| inoculation proximity           | 2  | 107.98  | ≤0.0001 |
| replicate                       | 3  | 8.15    | 0.0001  |
| rate*time                       | 3  | 2.89    | 0.0417  |
| rate*inoculation proximity      | 6  | 0.77    | 0.5942  |
| time*inoculation proximity      | 2  | 0.90    | 0.4113  |
| rate*time*inoculation proximity | 6  | 1.21    | 0.3096  |

Foliar % N significantly differed by N rate and field trial location; with the highest N rate (160 lb N/A) and the Landisville trial location having the highest mean foliar % N values ( $P \leq 0.0001$  for both). When evaluating foliar % N data separately for each trial ( $n=32$ ), both Rock Springs trials had significant, positive relationships with % center rot at harvest, while no significant relationship was observed at Landisville. The foliar % N sampling taken at bulb initiation was the only significant factor predicting center rot at harvest in the 2016 Rock Springs trial ( $P=0.0007$ ;  $R^2=0.3224$ ) while the early-season foliar % N sampling was the only significant factor predicting center rot at harvest in the 2015 Rock Springs trial ( $P=0.0002$ ;  $R^2=0.3681$ ). When foliar % N sampling data from all three trials were collectively analyzed ( $n=96$ ), only

bulb initiation foliar % N sampling (week ten) was a significant factor predicting center rot at harvest ( $P \leq 0.0001$ ;  $R^2 = 0.5046$ ). This relationship slightly improved when analyzed as a quadratic term ( $P \leq 0.0001$ ;  $R^2 = 0.5225$ ; Fig. 2). When dry weight data was included in this analysis, the relationship slightly improved and mid-season foliar % N ( $P \leq 0.0001$ ), bulb initiation foliar % N ( $P = 0.0078$ ) and bulb initiation dry weights ( $P = 0.002$ ) were significant factors predicting center rot at harvest (Model  $P \leq 0.0001$ ;  $R^2 = 0.6114$ ). When neck diameter and bulb diameter measurements from uninoculated sub-sub plots were added to the analysis, the mid-season and bulb initiation foliar % N samplings remained in the model but the bulb initiation dry weight variable was removed and the late-season neck and bulb diameter ( $P = 0.0019$  and  $P = 0.0077$  respectively) and mid-season bulb diameter ( $P = 0.0331$ ) variables were added (Model  $P \leq 0.0001$ ;  $R^2 = 0.6885$ ). Adding interaction terms to these models did not improve the relationship (data not shown). No multicollinearity was indicated among sampling mid-season foliar % N, bulb initiation foliar % N, bulb initiation dry weight, late-season neck diameter and mid- and late-season bulb diameter variables (variance inflation factors [VIFs]  $< 1.5$ ; data not shown).



**Fig. 2.** Relationship between week ten (bulb initiation) foliar % N and center rot incidence at harvest, combined data from 2015 and 2016 trials. Center rot incidence is the sum symptomatic bulbs in a sub-plot as a percentage of total bulbs harvested per plot. Each point represents one sub-plot ( $P \leq 0.0001$ ).

When marketable yield data was pooled across inoculation proximity (sub-sub plots), marketable weight of jumbo and colossal sized bulbs ranged from 48.1 to 162.5 lb for 2016 Rock Springs, 54.7 to 89.3 lb for 2016 Landisville and 0.4 to 87.7 lb/60 ft row length harvested at 2015 Rock Springs trials. In all three trials, total marketable yield was not significantly different between the three N rates, excluding the control, and the reduced rate of 105 lb N/A had the highest numerical marketable yield. When marketable yield data was split by inoculation proximity, N application timing was significant in the 2015 Rock Springs trial ( $P = 0.0166$ ), nearly significant at Landisville ( $P = 0.0958$ ), and a significant interaction occurred between rate and time ( $P = 0.0112$  for Landisville and  $P = 0.0281$  for 2015 Rock Springs). Marketable yield was significantly lower in the inoculated sub-sub plots than adjacent and

uninoculated sub-sub plots at Landisville ( $P \leq 0.0001$ ) but not Rock Springs ( $P = 0.3765$  for 2016 and  $P = 0.2030$  for 2015).

**Objective 3: Evaluate the susceptibility of onion cultivars to center rot, the most common bacterial disease affecting onion in PA.**

In a total of three trials conducted over 2015 and 2016, 13 cultivars were evaluated in one or more trials. The onion cultivars evaluated included Lasso, Great Western, Aruba, Ovation, Dulce Reina, Spanish Medallion (Sakata Seed America, Morgan Hill, CA), Sedona, Crockett, BGS 280 F1, BGS 300 F1 Blush, Red Sky, Expression (Bejo Seeds, Inc., Oceano, CA) and Candy (Seedway, LLC, Hall, NY). The cultivars were selected with the guidance of Dr. Mike Orzolek, Emeritus Professor of Horticulture at Penn State. These cultivars were grown from seed in the greenhouse at the Plant Pathology Farm at the Russell E. Larson Agricultural Research Center (Rock Springs) in PA Furnace, PA. Twelve-week-old greenhouse-grown onion transplants were planted at Rock Springs on April 28, 2015 and April 19, 2016 and at the Penn State Southeast Agricultural Research and Extension Center in Manheim, PA (Landisville) on April 14, 2016. Onions were grown using standard black plastic with a double row of drip irrigation. Each treatment plot was 4 rows wide planted at 6 in. standard onion spacing. The 2015 plots were 20 ft in length and 2016 plots were 13 ft in length. Treatments were arranged in a randomized complete block design with four replications and split by inoculation proximity. A subset of plants in each plot was toothpick inoculated with a mix of *P. ananatis* and *P. agglomerans* isolates as the sub-plot (inoculation proximity). The inoculation proximity split-plot design was used to establish various levels of inoculum pressure. Inoculated, adjacent to inoculated, and uninoculated onions were rated separately for disease incidence and severity. Crop fertility, insects and weeds were managed using standard commercial practices.

Prior to harvest, plots at Landisville were rated for foliar disease severity (using the same scale as described for Objective 2) a total of three times while those at Rock Springs were rated five and four times in 2015 and 2016, respectively. At three points during the season (early-, mid- and late-season) horticultural measurements including bulb diameter at its widest point and neck diameter mid-way between the apical meristem and bulb were recorded for five representative onions from each sub-plot totaling 15 onion plants per replicate plot. Plots were harvested individually by sub-plot (inoculation proximity). The number and total weight of bulbs with center rot (onions with symptomatic neck scales) symptoms were recorded, and marketable and unmarketable bulbs were graded by size and weight as described previously (Objective 2). A subsample of 10 jumbo- and/or colossal-sized, asymptomatic onions were analyzed for soluble solids (%) and pungency as determined by pyruvic acid content (Waters Agricultural Laboratories, Camilla GA). Another sub-sample of 20 asymptomatic jumbo- and/or colossal-sized onions from adjacent to inoculated and uninoculated sub-plots were comingled by replicate and cured and placed in 4°C storage. Post-harvest center rot incidence (presence or absence of symptoms) was evaluated after three-months in storage by slicing each bulb in half longitudinally.

Data were analyzed using the one-way analysis of variance procedure in Minitab 17.2 (Minitab Inc., State College, PA). ANOVA with two or more factors were analyzed in SAS 9.4

(SAS Institute, Cary, NC). Center rot incidence was square root transformed in ANOVA to satisfy the assumption of normality. Post-hoc comparisons were completed using Fisher's LSD and Tukey's HSD,  $\alpha = 0.05$ . Using the General Linear Model procedure, cultivar, inoculation proximity and block (replicate) were input as class variables and block was labeled as random. Center rot incidence at harvest in 2015 did not have a normal distribution when analyzed as the split-plot design (n=120) despite transformation attempts so these data were compared between trials as the whole-plot (n=40), which was normally distributed when square-root transformed. Comparisons of severity distributions were conducted using the Kruskal-Wallis test in Minitab. Multiple linear regression was performed using the stepwise addition procedure with center rot incidence (%) at harvest and/or post-harvest analyzed as the dependent variable, which was the total split-plot incidence.

**Objective 3 Results and Discussion.** One-week prior to harvest, foliar disease severity significantly differed between cultivars in the inoculated sub-plots in both Rock Springs trials ( $P \leq 0.001$  in 2015;  $P=0.002$  in 2016) but not Landisville ( $P=0.203$ ). Compared to cv. Candy, median foliar center rot severity ratings of inoculated onions were lower for cvs. Lasso, Blush, Spanish Medallion and Expression at Rock Springs in 2016, Expression and Great Western at Rock Springs in 2015, and all cultivars except for Aruba at Landisville in 2016 within one-week prior to harvest.

Cultivars Blush, Red Sky, Crockett, Sedona, Spanish Medallion, and BGS 280 had lower center rot incidence at harvest compared to cv. Candy in 2015 and 2016 trials at Rock Springs. All cultivars evaluated at Landisville had lower center rot incidence at harvest compared to cv. Candy, although these differences were not significant ( $P=0.621$ ). In all three trials, the only cultivar to have lower center rot incidence than cv. Candy at harvest while still producing comparable marketable yields and percentage of jumbo and colossal-sized bulbs to cv. Candy was Spanish Medallion.

In 2015 and 2016, marketable yield ( $\geq 3.0$  in. bulb diameter) means ranged between 14.5 and 141.9 lb/100 ft of harvested row. Cultivar Expression had the highest marketable yield and percentage of bulbs that were jumbo or colossal in size (Table 4). Cultivar Candy had numerically fewer jumbo- and colossal-sized bulbs and lower total marketable yield compared to Expression in all three trials. Cultivars Ovation, Great Western, Spanish Medallion and BGS 280 were not significantly different from Candy in terms of the percentage of jumbo and colossal-sized bulbs or marketable yield in all three trials. Cultivars Sedona, Blush, Dulce Reina, Crockett and Aruba had the lowest yields and percentage of jumbo- and colossal-sized bulbs in all three trials.

All cultivars evaluated met the minimum sugar criteria in all three trials but the pungency criteria for the PA Simply Sweet Onion Program were not met in the 2016 trials. The highest sugar values in all three trials were from the two red onion cvs. Blush and Red Sky. Compared to cv. Candy, cvs. Aruba, Sedona, Great Western and Crockett had higher sugar values in one or more trials. Pungency was lower in cvs. Blush, Great Western, Expression, Aruba, Spanish Medallion and Crockett compared to cv. Candy in one or more trials.

**Table 4.** Jumbo- and colossal-sized bulbs by cultivar compared to standard cv.

Candy. The percentage of jumbo- and colossal-sized bulbs is out of the total asymptomatic bulbs harvested. Data were analyzed using ANOVA and when significant ( $\alpha = 0.05$ ), means were separated using Tukey's HSD (SAS 9.4).

| Cultivar          | % Jumbo- and colossal- sized bulbs |      |                       |    |                      |    |
|-------------------|------------------------------------|------|-----------------------|----|----------------------|----|
|                   | Rock Springs,<br>2015              |      | Rock Springs,<br>2016 |    | Landisville,<br>2016 |    |
| Expression        | 84.1                               | a    | 97.9                  | a  | 88.9                 | a  |
| Candy             | 79.1                               | a    | 96.4                  | a  | 76.9                 | a  |
| Ovation           | 74.4                               | ab   | -                     | -  | -                    | -  |
| Great Western     | 73.4                               | ab   | 97.4                  | a  | 84.0                 | a  |
| Spanish Medallion | 65.3                               | abc  | 93.0                  | ab | 62.1                 | ab |
| BGS 280           | 57.2                               | abcd | -                     | -  | -                    | -  |
| Red Sky           | 47.9                               | bcd  | 70.5                  | dc | 46.0                 | bc |
| Aruba             | 42.9                               | cd   | 71.3                  | dc | 49.2                 | bc |
| Sedona            | 32.5                               | d    | -                     | -  | -                    | -  |
| Blush             | 30.4                               | d    | 54.3                  | fe | 17.3                 | d  |
| Lasso             | -                                  | -    | 80.8                  | bc | 47.3                 | bc |
| Dulce Reina       | -                                  | -    | 65.7                  | de | 35.0                 | dc |
| Crockett          | -                                  | -    | 43.6                  | f  | 23.6                 | dc |
|                   | P ≤ 0.001                          |      | P ≤ 0.001             |    | P ≤ 0.001            |    |

The significant, weak, linear relationship found between early-, mid- and late-season neck diameter measurements and center rot incidence post-harvest suggests that larger neck diameters may have higher center rot disease incidence post-harvest. This was observed in cultivars like Aruba that had consistently large neck diameters late-season along with high foliar disease severity and high center rot incidence at harvest and post-harvest. Therefore, it may be more important for PA onion growers to select cultivars that generally do not have larger neck diameters. Cultivars Aruba, Crockett and Dulce Reina had large neck diameters late-season in addition to high disease incidence and/or variable disease incidence at harvest and post-harvest. Center rot foliar severity ratings were also highest late-season around the time of harvest. Cultivars that have larger neck diameters at harvest may provide more favorable conditions for the movement of *P. agglomerans* and *P. ananatis* from the neck to the bulb, which is why higher center-rot disease incidence was observed in these onions post-harvest. However, cv. Blush had consistently large neck diameters late-season and low disease incidence at harvest and post-harvest, which explains why the relationship between onion neck diameter and center rot incidence post-harvest was weak.

**Objective 4: Develop scouting guidelines and establish visual disease thresholds to aid growers in harvest timing decisions in fields under pressure from bacterial diseases.**

To evaluate the effects of inoculum pressure and onion maturity on harvest and post-harvest losses due to bacterial disease, **one split-split plot replicated field trial** was established in 2016 at the Plant Pathology Farm at Russell E. Larson Research and Education



Center at Rock Springs in Centre Co. The trial was planted on standard black plastic with a double row of drip irrigation. Each plot consisted of a 36 ft section of bed, 4 rows wide with 6-in. plant spacing within plants and between rows. Each plot was split into inoculated and uninoculated subplots (18 ft each) as has been previously described. Plots were arranged in a randomized complete block design with five replications. On 15 Jun, the fourth leaves from the outside of each plant in two rows (one outer, one inner) of the inoculated plots were toothpick inoculated with a bacterial suspension containing a mix of *Pantoea agglomerans* and *P. ananatis*, the same as previously described. Crop fertility, insects and weeds were managed using standard commercial production practices. Treatment plots were harvested at weekly intervals on 24 and 30 June, and 6, 15 and 20 July to reflect increasing stages of maturity. Prior to harvest, 20 plants per plot were rated for visual symptoms using the 0 to 7 scale before two 15 ft rows of the plot were pulled, topped and graded for size and marketability. The incidence of center and surface rots was recorded separately based on inoculation proximity to reflect varying levels of bacterial inoculum pressure. A sub-set of 30 marketable onions from each plot was dried for two weeks, then stored for 10 additional weeks in a cool, dark storage barn and graded for post-harvest bacterial disease incidence.

In addition, five replicate plots (30 ft in length) were established in each of **four grower-collaborator onion fields**. Two fields were located in eastern Centre Co. and two in central Lancaster Co., PA. Soil temperature sensors were placed in the center of each plot, and disease and pest management were left to the grower's discretion. After plot establishment and prior to harvest, 30 plants per plot were visually rated each week for bacterial disease severity. At harvest, the inner 15 ft of each plot was pulled, topped, and graded for size and marketability as closely as possible to the grower's selected harvest date; for most growers, this was between 14 and 18 July. Harvest data from one of the Lancaster field locations was lost due to the field being mechanically harvested before data from the observational plots could be collected.

**Objective 4 Results and Discussion.** With each successive harvest of the replicated field trial at Rock Springs, the proportion of jumbo and colossal-sized onions increased, with the most dramatic increase occurring between 6 Jul and 15 Jul. This is similar to what has been observed in previous trials. Disease pressure in the replicated field trial was very low with average foliar disease severity ratings remaining below 1.0 over the course of the entire trial. As a result the relationship between foliar disease severity and center rot incidence at harvest was also very low ( $R^2 = 0.17$ ). Although disease severity was low, the most significant increase in the percent disease incidence at harvest occurred between weeks 3 and 4 which was approximately 10 weeks after planting during bulbing.

Unfortunately, disease pressure was also very low on the commercial farms as a result of the hot and dry 2016 season. The percent disease incidence at harvest across all the commercial field plots ranged from 0 to 7.7% with disease incidence being slightly higher on average in the field in Lancaster Co. compared to those in Centre Co. Also on this farm there was a proportionally higher percentage of marketable colossal onions compared to the other two commercial farms although overall total marketable yield was less (284 lb/100ft compared to 302 and 346 lb/100ft on the Centre Co. farms. Foliar center rot disease severity was also very

low across all the field sites ranging between 0 and 1.2 (1 = local lesion, < 1-in.<sup>2</sup>).

**GOALS AND OUTCOMES ACHIEVED:**

The goal of this research was to increase the number of integrated and targeted research-based management tools available to growers for managing bacterial diseases of onion, specifically center rot. The three management strategies evaluated were cultivar selection, augmented nitrogen fertigation programs and pre-plant onion transplant treatments. These strategies were targeted as a result of an extensive two-year on-farm survey of approximately 60 farms statewide which sought to identify environmental and production factors related to increased losses in commercial fields.

Based on *in-vitro* and laboratory transplant assays, a number of products including hydrogen dioxide, hydrogen peroxide with mono- and di-potassium salts of phosphorus acid, copper sulfate pentahydrate and streptomycin sulfate were determined to be effective at reducing epiphytic bacterial populations from the surface of transplants. This could be an important tool in reducing a potential source of inoculum. Many of the treatments evaluated are already labeled for use in onion production, therefore minimal adjustments would need to be made to the product label to encompass a pre-plant application. The next step will be to track the efficacy of pre-plant transplant treatments to the field through use of a rep-PCR method that can be used to track specific strains used for inoculation and document survival during the season.

Currently, there are no known onion breeding programs targeting center rot diseases, nor have there been many trials to evaluate the susceptibility of commercially available cultivars. To address this knowledge gap, 13 onion cultivars were evaluated for center rot susceptibility, marketability and select horticultural characteristics. The only cultivar to have lower disease incidence and severity and comparable yields to the grower standard cv. Candy was cv. Spanish Medallion. The next step will be to evaluate this cultivar on a number of commercial farms to see how it performs under more diverse field settings.

Preliminary data suggested that applying total crop nitrogen prior to onion bulbing increased total yield and reduced bacterial disease incidence. Also, it was observed that low lying areas in heavily manured fields used for onion production have had up to 83% bacterial bulb decay incidence at harvest. Based on this knowledge, we evaluated whether the timing and rate of nitrogen application could reduce center rot losses at harvest. A positive, quadratic relationship was found between foliar nitrogen levels at bulbing and center rot incidence at harvest. Further fine-tuning this relationship and developing a predictive model that factors foliar tissue %N along with environmental conditions could be a useful tool that growers use to help make either harvest timing decisions or marketing decisions. An interaction existed between N rate and application timing (half vs full season applications) but trends in this relationship were variable based on field trial location. This may have been due to the high level of disease pressure at Landisville indicating that there might be a disease threshold above which augmenting nitrogen applications may not have a benefit.

Although the least progress was made on the development to guidelines and the

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|                  | <p>establishment of visual disease thresholds to aid growers in harvest timing decisions, in part due to the hot and dry 2016 season, regular scouting for bacterial disease symptoms remains an important component to an integrated disease management program. Scouting the four commercial farms weekly provided an opportunity to work one-on-one with the growers showing how to identify and rate foliar disease symptoms during the season and bulb symptoms at harvest. There was also ample discussion of management options and how they could be incorporated onto those specific farms. One tool that has become increasingly adopted is the use of reflective silver or silver-on-black plastic mulch for onion production. This alternative mulch reduces the soil temperatures at bulbing that have been significantly correlated to increase disease incidence at harvest.</p>  |
| Beneficiaries:   | <p>The results of this research will have an immediate and direct impact on all PA sweet onion growers by increasing the number of tools available to incorporate into an integrated program for the successful management of bacterial disease of onion, thus directly impacting farm profitability. Onion production fits nicely with our already-established diversified vegetable production system in terms of crop rotation, season length, equipment requirements and labor availability, etc. As we succeed in managing these onion diseases, current growers will sustain or increase their acreage and more growers will start producing onions, thus building the fresh market onion industry in PA. Although beyond the 2-year duration of this proposed project, economic impact can be measured by the continued increase in total acres in production in PA as well as the number of 40 lb boxes harvested per acre; increases both in the total number of marketable bulbs and bulb size (<math>\geq 3</math>-in. diameter) will result in increased marketable boxes per acre. Since bacterial diseases are the primary production constraint, reductions in the percentage of culled bulbs at harvest and post-harvest are another metric for measuring impact. The results of this research would also be applicable for other similar onion production systems which are primarily located in the Northeastern U.S., however the results may be adapted to larger scale onion production in other regions in the U.S. The general public will also benefit from having access to an increased supply of affordable locally-grown onions as will the packing houses, produce auctions and local groceries involved in the supply chain.</p> |
| Lessons Learned: | <p>As with many diseases, disease development is highly dependent on environmental conditions. Trials were conducted at Penn State Research Farms in both Centre and Lancaster Co. to reflect differences in environmental conditions which directly impact disease development. Over the past couple of years, the number of farms in central PA participating in the PA Simply Sweet Onion Program has increased to the point where a second packing facility was built in eastern Centre Co. and utilized for first time in 2016. This is in part due to the less favorable environmental conditions for bacterial disease development in the central versus southeastern part of PA. In the future at Rock Springs, overhead misters are going to be used to help increase disease pressure under prolonged dry conditions. However, this will need to be balanced with the potential development of foliar fungal diseases such as purple blotch and Stemphyllium leaf blight which will need to be managed with regular fungicide applications.</p>  |

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|                   | <p>Onion cultivars differ in the optimal days to maturity. In these trials, in order to facilitate a simpler statistical comparison between treatments, the cultivars were harvested at the same time regardless of the percent lodging (measure of natural maturity). In future trials, it may be important to use lodging as an indicator of bulb maturity for each cultivar as this could impact disease assessment. It is thought that <i>P. ananatis</i> moves from the leaf to the bulb tissue once the leaf is lodged. Therefore, it may be that we are underestimating disease, particularly post-harvest disease incidence, in cultivars such as Sedona and Dulce Reina that did not lodge prior to harvest. Sacrificing bulb size by harvesting onions prior to lodging may be a tactic that growers can use to prevent the center rot pathogens from entering the bulb which is was the strategy being addressed in objective 4.</p>   |
| Contact Person:   | <p>Beth K. Gugino<br/>Associate Professor - Vegetable Pathology<br/>Department of Plant Pathology and Environmental Microbiology<br/>The Pennsylvania State University<br/>814-865-7328<br/>bkgugino@psu.edu</p>  |
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| <b>Project 18</b> | <b>Expanding Best Practices Programs in the Mushroom Industry</b>   |
| Project Summary:  | <p>This project continued to educate and train mushroom farm employees on “best practices” created through prior Specialty Crop Block Grants (SCBGs) as well as define new best practices that fit new regulations and an ever-changing workforce. Training programs developed through previous SCBGs have illustrated a growing need for more food and farmworker safety training in the mushroom industry.</p> <p>Developing and expanding best practices programs allow the mushroom industry to proactively prepare to comply with the Food Safety Modernization Act (FSMA). Farmworker safety programs address needs raised by the Occupational and Safety Health Administration’s (OSHA) recent focus on agriculture and contract worker safety and by the Environmental Protection Agency (EPA) on protecting workers from pesticides.</p> <p>This project developed new and expanded current best practices programs to reach both new and existing employees who have benefited from the training. Training was provided in English and Spanish, reflecting the diverse workforce in Pennsylvania’s mushroom industry.</p> |
| Project Approach: | <p>The AMI staff coordinated meetings for the AMI Food Safety Task Force, AMI/OSHA Alliance Committee and the Integrated Pest Management (IPM) Committee. Staff partnered with Penn State faculty and Extension personnel, mushroom industry experts and consultants to determine areas where training programs and accompanying materials in food safety and worker safety were needed.</p> <p>This was measured by tracking attendance at training events and by tracking farms that receive training materials, as well as comments from stakeholders. Data sources included evaluations at training programs and questionnaires accompanying training materials. Interviews with employees, owners and presenters constituted another data source. Many training sessions were held in English and Spanish. Project results were shared with the</p>  |

mushroom industry both in the United States and in other mushroom-producing countries through publication in AMI’s monthly trade magazine, *Mushroom News*.

Project Activities:

1. **Discuss with AMI Food Safety Task Force, AMI/OSHA Alliance, IPM Committee and other industry experts the programs that need to be updated or expanded.**

Summary: Committee meetings were held regularly to determine the needs and opportunities to conduct workshops and educational materials. Through discussions at these meeting, projects were developed to meet the objectives.

2. **Review regulations such as FSMA and Agricultural Worker Protection Standard (WPS) to fine-tune possible training needs.**

Summary: FSMA, WPS and OSHA current and revised standards were monitored by AMI staff and consultants and information was provided to the Committees to develop training needs to comply with new regulations.

3. **Create and/or revise training programs and related materials.**

Summary: Training programs were created and related materials were reviewed for updates. New materials were developed and distributed for secondary chemical container labels. The AMI website was maintained and updated to ensure all the training material and presentations are available to mushroom growers nationally so they can keep up-to-date on the latest food and worker safety programs and information.

4. **Develop new food safety training based on FSMA and GFS requirements.**

Summary: A food safety training app was created to train packinghouse and farm workers on federal and private auditing mandates.

5. **Schedule and conduct training programs.**

Summary: Training programs were conducted for worker safety contractor train the trainer; educational presentations at the AMI-OSHA Alliance Committee meetings; food safety training; worker safety for lock out/tag out and electrical hazards; and ammonia training. Attendance and evaluations completed by attendees were collected to ensure the programs were well received and useful.

The project was overseen by the American Mushroom Institute Board of Directors, the Board

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|                              | of the Mushroom Farmers of Pennsylvania and the AMI staff, with the goal to track the objectives and assist with training development, delivery and compilation. The AMI and MFPA Boards provided oversight for the consultants and others involved in the development of the best practices programs and delivery of training sessions to industry members.  |
| Goals and Outcomes Achieved: | <p>The goals and outcomes for the project included creating and providing training materials and programs to farm owners and employees. As with previous grants, success of the project was measured through attendance at training programs, evaluations and distribution of training materials to farm owners.</p> <p>We successfully reached our goal by increasing farmworker, supervisor and mushroom producer knowledge of best practices programs in the areas of food and farmworker safety. The following meetings and training workshops were held along with regular Food Safety Task Force, Integrated Pest Management and AMI-OSHA Alliance Committee meetings.</p> <ol style="list-style-type: none"> <li>1. Ammonia Train the Trainer – December 2014 (12 participants)</li> <li>2. Pesticide Applicator Credit Training (English and Spanish) – Provided assistance with planning and promotions for sessions held in February and October 2015; and February and September 2016</li> <li>3. Ammonia Training – June 2015 (28 participants)</li> <li>4. Electrical Hazards (English and Spanish) – Two sessions held in April 2015 (17 participants) and two sessions held in July 2015 (30 participants total)</li> <li>5. AMI-OSHA Alliance Committee Annual Meeting – May 2015 (80 participants); April 2016 (54 participants)</li> <li>6. Food Safety Training – July 2015 (35 participants)</li> <li>7. Lock Out/Tag Out Training (English and Spanish) – Three sessions held in April 2015 (24 participants) and July 2015 (17 participants)</li> </ol> <p>AMI's Safety Alliance Committee participated in an additional Specialty Crop Block Grant project through coordination with the Chester County Economic Development Council which supported workforce training to the mushroom industry in 2015-2016.</p> <p>AMI helped support "The ABC's of Supervision in the Mushroom Industry," an eight-hour supervisory course for employees transitioning to a supervisory role in the industry, from mushroom production areas to packing and processing. A total of 3, 2 part sessions were offered, two in Spanish and one in English with 99 people attending the training course.</p> <p>AMI also helped support Penn State Pesticide Applicator Credit Training and Food Safety Training workshops through assistance with promotions and information delivered to AMI members.</p> <p>The AMI website has been maintained and updated to make all the training material and presentations available to mushroom growers nationally to keep up-to-date on the latest food</p> |

and worker safety programs and information. The following information was added through the grant period:

1. Spring 2014 – IPM section underwent an annual update with current information, labels and material safety data sheets. New pesticides were added making it more comprehensive and a useful tool for growers. The Workplace Safety section was updated to include a presentation from the AMI/OSHA Alliance General Meeting focusing on Accident/Incident Investigation Process.
2. Spring 2015 – A presentation was added to the website in the Food Safety Training Tools section, “Food Safety Train-the-Trainer Session for Contractors Working on Mushroom Farms” and training material including an instructor’s guide, a basic food safety poster, an employee commitment form as well as a contract that can be used between farms and contracted companies. The information is provided in English and Spanish. Additionally, PowerPoints on Worker Safety for Contracted Employees and Ammonia Safety Train-the Trainer presentations have been added to the Worker Safety, Safety Training section. These programs are also provided in English and Spanish.
3. Summer 2015 – The Integrated Pest Management section was updated to ensure all labels, safety data sheets and product information are current.
4. Fall 2015 – The Electrical Hazards Training in Spanish was added to the Workplace Safety section.
5. Winter 2016 – Two updates were made to the Insecticides and Fungicides pages of the Integrated Pest Management section.
6. Spring 2016 – Two updates were made to the Insecticides and Disinfectants pages of the Integrated Pest Management section.
7. Summer 2016 – Presentations from the AMI-OSHA Alliance General Meeting were added to the website. An OSHA Updates presentation was added to the Worker Safety section. The Soft Cost of Injuries, Ergonomics Training and Workers Compensation Costs presentations were also added to the Worker Safety-Safety Training section.
8. Fall 2016 – Two new Food Safety and Worker Safety Training Apps were added for members to download for training purposes. Label templates for Service Secondary Container Labels were also added for members to download.

AMI staff and consultants also facilitated meetings of the Food Safety Task Force to create new educational and training tools for the industry in both English and Spanish. Members of the Food Safety Task Force, staff and consultants are in the process of incorporating FSMA

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|                  | changes and other updates for a new version of the Mushroom Good Agricultural Practices (MGAP) to have an MGAP 2.0 version which will enable the mushroom industry to align with GFSI and USDA audit requirements.  |
| Beneficiaries:   | The beneficiaries of this project are the 66 mushroom farm operations in Pennsylvania. Those who attend training programs initially benefited with additional beneficiaries including others in the industry who are trained through train-the-trainer programs and everyone who accesses the training information through the AMI website. By offering programs and training materials in Spanish as well as English, more Spanish-speaking employees, composters, growers and owners were able to utilize the materials.  |
| Lessons Learned: | <ol style="list-style-type: none"> <li>1. Because of the transience of mushroom farm workers, many workers being new or contracted workers; it is critical that food and worker safety training sessions be offered continuously and reinforced regularly.</li> <li>2. Because the process of growing and harvesting mushrooms changes with technological advances in production methods in addition to new regulations like FSMA, it is critical to keep updating the methods and materials used to provide food and worker safety training.</li> <li>3. Because of time constraints, language barriers and the transience of the mushroom farm workforce, it is important that training tools be bilingual, varied in means of presentation and accessibility.</li> </ol> |
| Contact:         | <p>Bev King<br/> bking@americanmushroom.org<br/> 610-268-7483</p>   |

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| <b>Project 19</b> | <b>Workplace Safety Training for the Mushroom Industry</b>  |
| Project Summary:  | <p>Even with increased opportunities for serious incidents due to automated or high-powered machines in the workplace, the work of the AMI Mushroom Employee Safety and Health Committee (MESH), (formerly known as the AMI- OSHA Alliance Committee) since 2008 has decreased the number of OSHA Standards citations. However, there is a need to continually train and create effective delivery methods as regulations and technology continue to change in an effort to make the workplace safer.</p> <p>There are several onsite hazards on mushroom farms that exist due to the nature of the work being done, most often resulting in trips, slips, falls, and strains. According to 2015 OSHA 300 log data submitted by southeastern Pennsylvania mushroom farms, 46% of restricted duty cases were due to a sprain/ strain injury, followed by slip, trip, or fall cases at 38% (MESH, 2016). Overall, 84% of restricted duty cases and 62% of lost time (from work) cases are either sprain/strain injuries or slip/trip/ or falls (MESH, 2016). Mushroom farm workers require training to adequately identify, and if possible, eliminate these hazards. While there are fewer accidents due to electrical hazards, the consequences of not accurately assessing and</p> |



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|                          | <p>eliminating these hazards are far more severe, resulting in electrocution and sometimes death.</p> <p>The purpose of this grant was to revise, develop, and deliver group trainings in areas of workplace safety including Lock Out Tag Out, Onsite Hazards, and Electrical Hazards for use by mushroom growers, packers, and composters to properly train new employees and retrain existing workers. These resources will be extremely valuable by providing a consistent training message across the industry, and have the potential to reach the most number of employees.</p> <p>The work accomplished through the 2012-13 Specialty Crops Grant was built upon by offering updated programs for those who participated in previous offerings, and expanding the trainings to new employees or supervisors who would greatly benefit. CCEDF completed the “Mushroom Industry Specialty Crops Project” in September 2013. We initially projected 240 mushroom industry employees would be trained in workplace and food safety. At completion, 420 employees representing 35 employers participated in one of 32 trainings that were held throughout the grant period.</p>   |
| <p>Project Approach:</p> | <p><b><u>Work Plan:</u></b></p> <p><b>Develop a project advisory committee to determine needs of project and scope of work.</b><br/> From October 2014- December 2014, the project manager met with members of the American Mushroom Institute (AMI)–OSHA Alliance Committee (now MESH). This group is a team of mushroom farm business owners and safety compliance officers who meet monthly to ensure they are up to date on OHSA regulations and meeting OHSA requirements for safety procedures and incident reporting. This committee served as the project advisory committee for “Workplace Safety Training in the Mushroom Industry”.</p> <p><b>Needs Assessment/Identification of Available Training and Resources</b><br/> From April-May 2014, the committee completed a needs assessment. 33 surveys were completed from representatives including grower farm members, suppliers, and packers. Survey results indicated priority workforce training topics for refresher and new employee training in the subjects of: MGAP Train-the-Trainer, <b>Supervisory/ Management Skills, Onsite Hazards, Electrical Hazards</b>, Hazardous Communication, and basic <b>CPR and First Aid Training</b>. It was also indicated, for example, that Electrical Hazards Training was most needed to be offered as “on farm” training and in Spanish.</p> <p><b>Update previous training and resources with new or modified guidelines/Implement an RFP/ scheduling updates trainings:</b></p> <p>In June 2015, the OSHA Alliance Committee members noted that many of their employees’ First Aid/ CPR certifications were coming up for renewal. For the amount of employees that each farm would like to have certified, this basic but essential training is very expensive. The majority of farms have multiple farm locations and/or businesses (i.e. growing room settings, packing houses, office settings) creating the need for a variety of employees to be trained, increasing the potential safety at different farm business locations. Based on our projected</p> |

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|                              | <p>costs for the entire project contract, we added this additional training due the strong interest and immediate need. This topic was the first training event scheduled for summer/ fall 2015.</p> <p>Based on the surveys and advisory recommendations, the next prioritized training determined by the MESH committee was a <b>Supervisory/Management Training</b> for employees who have recently transitioned to a supervisory role. This in-person, classroom training was offered in summer 2016.</p> <p>Though multi-media platforms such as videos and flip books were considered as a potential training tool for updating, ultimately it was decided by the MESH committee that a <b>safety application (app)</b> would be best to develop. The app training would allow greater access for farm management and HR professionals to deliver a training at multiple farm locations away from the traditional office or training location. Consequently, the American Mushroom Institute was already in talks about converting their Food Safety training to an app as well so this project was timely to keep new training formats uniform for the industry.</p> <p><b>Project Partners:</b></p> <p>The grant partners included the American Mushroom Institute (AMI) and their MESH committee, Penn State Extension, and over 40 mushroom growers located in the PA counties of Berks, Chester and Delaware. In addition, members of the 2012 Specialty Crops Grant Advisory Committee continued to serve for this grant project. Those project partners include AMI, Murray Securus, Richard Enterprises, and mushroom farms including ToJo Mushrooms and Pietro Industries. These partners participated integrally in the project; worked collectively toward achieving the goals and outcomes; and collaborated with the CCEDF in implementing the training projects.</p> <p>The project partners gave consistent feedback throughout this grant to help focus the selected trainings. John Hillard of Murray Securus, developed the draft script for the safety training application. Along with the contracted app developer, Food Safety CTS, John Hillard, CCEDF Project Coordinator, Katie Poppiti, and MESH committee members reviewed and finalized the draft over several weeks. Once the content was created, farms such as ToJo mushrooms lent their time, equipment, and employees to help create photos and video content for the training app. This was critical for the app development team so that they could effectively gain content in a timely manner with respect for both budget and time of farm or packing facility staff that assisted the photographer/videographers.</p> |
| Goals and Outcomes Achieved: | <p><b>GOALS AND OUTCOMES ACHIEVED:</b></p> <p><b><u>First Aid/ CPR Training:</u></b></p> <p>Zee Medical Services was selected as the contracted training provider. This training program was completed in August and September, 2015. Mushroom industry owners, supervisors, and employees participated in one of eight training sessions in CPR, First Aid, and automated external defibrillator (AED) training. Six sessions were provided in Spanish and two in English. <b>A total of 87 employees from twelve different companies received their First Aid and CPR certification.</b> 86% of trainees ranked the training as “Excellent.”</p>   |

The Zee Medical staff was well received and the training was greatly appreciated by mushroom farm businesses and the OSHA Alliance. Richard Rush, Safety Manager at Kaolin Mushroom Farm, was able to have 20 employees trained, working in eleven different job locations and functions (i.e. growing farm, safety, packing, and HR). Participant surveys noted that they “feel more prepared to help in emergency situations” and are more “aware of situations needing medical help.”

**Supervisor/Management Training:**

In spring/ summer 2016, Food Safety CTS, was contracted to deliver three sessions of Supervisor Training, titled “The ABC’s of Supervision in the Mushroom Industry” (curriculum attached). Each session was offered in 2, 4 hour segments over a few weeks. These were intentionally scheduled so that employees did not miss an entire day of work and that the information could be better absorbed over multiple sessions. Two of the three sessions were offered in Spanish and the final session was offered in English.

This training course covered a robust range of topics and including real world scenarios that can be found on a mushroom farm. Course topics included the following:

- Importance and scope of supervisory positions
- Methods to adapt to the position
- Supervising family and friends effectively
- How to follow-up and enforce company policies and procedures
- Time management skills to plan and set priorities
- Leadership skills and traits
- Knowledge and skills to effectively communicate with employees
- Activities to help a supervisor to be more effective

The curriculum also provided case studies, offering on farm scenarios and questions for participants to discuss with others (see attached).

**A total of 99 employees representing 17 different mushroom farm businesses and packing operations completed this training.** All participants received a certificate of completion.

The course was extremely well received. Survey feedback included comments such as, “I now understand what it really means to be a supervisor.” Other comments included, “I learned to be a better leader and help improve aspects in my company...I learned how to solve specific problems.”

**Application:**

After receiving required bids, Food Safety CTS was also contracted to complete the app project. The Food Safety CTS team has years of experience developing training programs and materials for the leafy green, fruit, and mushroom industry in food safety. It was a natural fit

that they lend their development expertise to a new training topic but one that had many overlapping components with Food Safety CTS's previous and existing work with the mushroom farm community.

The worker safety app highlights five areas of on-site hazards including 1) Caught-In Hazards, 2) Struck-By Hazards, 3) Sprain & Strain Hazards, 4) Fall Hazards, and 5) Electrical Hazards. All 5 sections take 25 minutes to complete or users can complete one or two at a time at their convenience. The app is available in Spanish and English on iTunes and will be available on Google Play by November 30, 2016.



The September and October 2016 issues of Mushroom News (national industry trade magazine of the American Mushroom Institute) included a short article and promotion about the safety training app (see attachments). The app information was also presented by the MESH Committee at the 2016 Mushroom Short Course at Penn State during the first week of October, 2016. In addition, the American Mushroom Institute recently sent out email blasts (see attached sample) to 800-1000, notifying membership of the app in addition to the recently released food safety app. As of October 18, 2016, the English version of the app had 238 impressions, while the Spanish version had 168 impressions (based on iTunes Analytics). The training can also be viewed on a computer through the AMI website: [www.americanmushroom.org](http://www.americanmushroom.org).

**Beneficiaries:**

The three training projects completed in this grant will directly affect numerous employees across different aspects of the entire mushroom farm business. While 12 mushroom farms participated in First Aid, CPR Training and 17 respectively in the Supervisor/ Management Training, the app will have an even greater reach to mushroom businesses outside of southeastern Pennsylvania, due to the national and international membership of the AMI. New and existing employees can now receive and utilize safety training using their own cellphones, tablets, and computers, convenient for easy access from places such as the "breezeways" at growing facilities to the board room at the farm office. A variety of

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|                  | <p>employees with different job duties from farm laborers to managers to sales and HR professionals received training in CPR/ First Aid. This invaluable training can truly save lives. Since farms have employees at multiple locations, i.e. the compost wharf, growing room, and packing facilities, it is important to have CPR/First Aid certified employees across business locations.</p> <p>The financial goal of the app is to reduce the risk of injury to employees, decrease OSHA recordable injuries, and decrease worker’s compensation expenses, ultimately resulting in less days that employees are away from the job. This will in turn result in cost savings to the employer.</p>   |
| Lessons Learned: | <p>The app was by far the most challenging project of this grant simply because it was much more complex than organizing an in-person training. This component had a lot of moving pieces, from script creation, re-writing and editing to scheduling both a photographer initially and later the videographer with Food Safety CTS. It took a great deal of time to develop, review, and refine both the learning concepts and the actual photos and footage and then repeat until the final product was cut.</p> <p>The initial feedback from the app has been great. One future recommendation that has come up is traceability. We were not able to achieve great traceability with this app. This additional component requires the integration of a learning management system which was out of reach financially for this grant budget. It is the hope that moving forward, AMI could take the lead in adding this component to the app, allowing for example, for training quiz results to a) sent directly to a supervisor email and/or b) allow for a section that could capture an employee ID (name and/or number).</p> <p>The First/ Aid and CPR training was very successful. Due to the hands on specifics on the training, registration is limited per class. Based on our determined budgets for each program, this unfortunately prevented us from offering even more training. We have received numerous requests in the past year indicating the need for this training.</p> <p>We learned through the Supervisor/ Management training that while the sessions were split into two segments to better accommodate employees not missing an entire work day, even a four-hour program was lengthy for some. In addition, we had planned to do the 2<sup>nd</sup> segment of each training one day to one week apart. Due to scheduling conflicts, the last session was several weeks apart making the first session concepts less fresh in the minds of trainees. It would be our recommendation to break the training course up into smaller segments while keeping the sessions close together.</p> <p>While specific outcomes (#s of employees trained by topics) in the training plan have not yet been achieved, we estimate that in the coming months, the app usage will increase as awareness continues to build. We anticipate that with the app, thousands of participants will gain knowledge in Lock Out Tag Out procedures, Machine Guarding, Electrical Hazards, and Sprain &amp; Strain Hazards. The training app. has the potential to directly impact about 5,000 mushroom industry workers, representing over 40 mushroom farm businesses. Once the OSHA 300 logs are complete for 2016, the MESH committee can analyze the year’s data to see if additional workplace injuries have decreased. We are confident that with support from the 2014-16 Specialty Crop Block Grant Program, we continued to build upon past success and develop new workplace safety resources to make the mushroom industry a safer place</p> |

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|                         | employees and employers, and allow the industry to remain a strong agricultural economic driver within the Commonwealth.   |
| Contact Person:         | Jodi Gauker/ Katie Poppiti<br>AgConnect Program Manager/ AgConnect Program Coordinator<br>610-321-8226<br><a href="mailto:jgauker@ccedcpa.com">jgauker@ccedcpa.com</a>   |
| Additional Information: | (MESH 2016). "Year in Review." Mushroom Employee Safety and Health Committee. American Mushroom Institute. Presented at the Penn State Mushroom Short Course. 3 Oct 2016.  |
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| <b>Project 20</b>       | <b>Enhanced Preparedness against Pathogens that Threaten Specialty Crop Production and Markets</b>   |
| Project Summary:        | Globalized agricultural trade and production systems facilitate the movement of known and novel pathogens. Their introduction and resulting disease outbreaks cause direct crop loss and increase costs for plant care. Diseases caused by exotic pathogens incur additional cost by requiring regulatory actions and disrupting trade. Historically, diverse pathogens have threatened the production and marketability of specialty crops in Pennsylvania. The main goal of this project (Jan. 1, 2015 - Dec. 31, 2015) was to enhance Pennsylvania's preparedness against pathogen threats to specialty crops via: a) improvement of pathogen diagnostics capability; and b) empowerment of stakeholders on the frontlines of defense by helping them to recognize emerging disease problems early and accurately. Main outcomes/products include: a) enhanced reference data sets that support the rapid and accurate identification and detection of multiple pathogens; b) improved understanding of the spatial and temporal diversity and variation of <i>Phytophthora</i> and <i>Pythium</i> species; c) a self-guided online training program for the identification of <i>Pythium</i> species that affect specialty crops; and d) enhanced understanding of the historical pattern of major bacterial pathogens associated with vegetable production. |
| Project Approach:       | <p><b>1. Reporting period</b><br/>January 1, 2015 – December 31, 2015</p> <p><b>2. List of All Personnel Associated with the Project and Their Roles:</b><br/> <b>Dr. Seogchan Kang</b>, PI and Professor of Plant Pathology at Penn State, coordinated the project and prepared the report<br/> <b>Sara May</b>, Co-PI, Penn State Plant Disease Clinic Supervisor &amp; Director of the Plant Health Resource Center, developed a new self-guided online training program focused on the identification of <i>Pythium</i> species in collaboration with Dr. Gary Moorman, Professor Emeritus of Plant Pathology at Penn State.<br/> <b>Dr. Ekaterina Nikolaeva</b>, Plant Pathologist at PDA, performed <i>Phytophthora</i> molecular diagnostic assays and prepared genomic DNA from <i>Phytophthora</i> isolates stored at PDA.<br/> <b>Dr. Seong H. Kim</b>, Plant Pathologist Supervisor at PDA, coordinated sample processing, helped data management and supported report preparation.<br/> <b>Dr. Jung-Eun Kim</b>, Penn State Postdoctoral Fellow, contributed to identifying <i>Phytophthora</i></p>  |

isolates via sequencing of their ITS (Internal Transcribed Spacer) regions of ribosomal RNA encoding genes.

**Dr. Alamgir Rahman**, Penn State Postdoctoral Fellow, was stationed at PDA. He has supported molecular diagnosis of *Phytophthora ramorum* and has characterized historical collections of *Phytophthora* isolates by sequencing their ITS regions in collaboration with J. Kim and E. Nikolaeva.

**Lucie Loftus**, summer wage-payroll assistant, worked with E. Nikolaeva in preparing pathogen cultures for preservation and genomic DNA extraction.

**Arielle Raugh**, summer wage-payroll assistant, worked with E. Nikolaeva in preparing pathogen cultures for preservation and genomic DNA extraction.

#### **PROPOSED WORK PLAN AND ACTIVITIES PERFORMED**

The following work has been carried out. Major discoveries/products from each area are summarized below:

##### **1. Identification of *Phytophthora* isolates from clinical and environmental samples**

Plant inspectors of the PA Department of Agriculture (PDA) have frequently encountered root rot symptoms on Christmas tree seedlings and intermediate-size trees during their inspection and certification services over the last 28 years. *Phytophthora* strains have been cultured from Christmas trees displaying *Phytophthora* root rot symptoms during 1986-2013. In 2014, we began molecular characterization of this collection of strains in order to understand the species diversity and spatial and temporal distribution patterns of individual species. Genomic DNA from all *Phytophthora* isolates was extracted in 2014. Species identity of the isolates collected during 1988-2004 was tentatively determined by sequencing the ITS (Internal Transcribed Spacer) regions of ribosomal RNA encoding genes. In 2015, we completed the same analysis for the remaining isolates (those isolated from 2005 till 2013). Initial analysis of resulting sequences indicated that many of the isolates belong to a species complex that has not been well resolved, requiring sequences from additional loci to accurately identify species. We are currently sequencing a mitochondrial gene to this end.

Another group of *Phytophthora* strains we began analyzing in 2015 is those cultured from stream baits deployed 15 eastern states, including Pennsylvania. These strains were isolated from plant leaf bait samples submitted to PDA for *P. ramorum* diagnosis by cooperators in 10-15 eastern states since 2010. Even though culturing *Phytophthora* was not a requirement, we decided to isolate *Phytophthora* (and some *Pythium* too), because we believed that resulting cultures and associated metadata would provide insights into the ecology of *P. ramorum* and other *Phytophthora* species in streams: a) which species are frequently captured from streams?; b) do any of them correspond to new species? If so, are they closely related to significant pathogens?; c) do individual states display unique species distribution patterns?; d) are there temporal patterns in species distribution?; and e) do different baiting methods (bait bags with whole leaves vs. Bottle O' Bait with leaf pieces) preferentially capture different species? If so, why? We completed genomic DNA extraction from more than 1,000 isolates for sequenced-based species identity determination as described above. In 2015, we have analyzed isolates from 83 Rhododendron bait samples deployed at 18 PA forest stream loci.

The species tentatively identified include *Phytophthora citricola*, *P. citrophthora*, *P. cryptogea*, *P. drechsleri*, *P. megasperma*, *P. hydropathica*, *Phytophthora* sp\_*Salix*soil, *Phytophthora* taxon *Pgchlamydo*, *Phytophythium* cf\_*citrinum*, *Phytophythium vexans*, *Phytophythium litorale*/*Ovatisporangium litorale*/*Pythium litorale*, and *Pythium* sp. Analysis of the isolates cultured from baits deployed in streams of other states will be conducted in 2016.

## **2. Improvement/Development of diagnostic resources for *Phytophthora* and *Pythium***

We have updated and improved *Phytophthora* Database ([www.Phytophthoradb.org](http://www.Phytophthoradb.org)). This online database mainly functions to support accurate and rapid identification of *Phytophthora*. Its reference sequence database currently houses sequence data from 1-12 loci for 2,623 isolates (representing 123 formally described species and 23 provisionally described species). This database has been utilized many users around the world (~1,500 uses per month on average). The main focus in 2015 has been on enhancing the security of this platform to prevent cyber attacks.

Dr. Frank Martin at USDA-ARS, one of the collaborator of our project, developed an isothermal amplification technique capable of detecting *Phytophthora* at a genus specific level in as little as 15 minutes with sensitivity approaching TaqMan real time PCR directly in the field without the need for DNA extraction as well as species-specific markers for multiple major pathogenic *Phytophthora* species. We provided field samples to him so that he could test his PCR probes and protocols for those species that are considered main threats to specialty crops in Pennsylvania. We will continuously work with him in 2016 to support him in expanding the collection of probes for more species.

Sara May, Co-PI of the project, developed a new self-guided online training program (<http://plantpath.psu.edu/pythium>) to facilitate the identification of *Pythium* species in collaboration with Dr. Gary Moorman, Professor Emeritus of Plant Pathology at Penn State. This freely available program consists of the following components: a) information that helps distinguish *Pythium* spp. from similar genera; b) techniques for isolating *Pythium* from plant material and water samples; and c) morphological and molecular identification techniques for commonly encountered *Pythium* groups and species. The main target group of this program includes plant disease diagnosticians and plant pathologists.

## **3. Characterization of bacterial pathogens isolated from tomato and pepper plants**

The PDA Plant Diagnostic Laboratory has isolated and archived 266 strains of bacterial pathogens isolated from >5,000 clinical tomato samples submitted to the lab since 1987. During the past several years, we have been analyzing this collection of pathogen cultures to understand the historical pattern of pathogens and to develop molecular diagnostic tools for specific pathogens. Based on traditional identification methods, 157 strains were found to belong to *Xanthomonas* spp., 67 to *Clavibacter* spp. and 38 to *Pseudomonas* spp. PCR assays showed that most *Pseudomonas* strains were *P. syringae* pv. *tomato*, while most *Clavibacter* strains corresponded to *Clavibacter michiganensis* pv. *michiganensis*. Molecular characterization of *Xanthomonas* strains, based on a combination of DNA fingerprinting by BOX-PCR and sequencing of their 16S ribosomal RNA encoding gene, led to the identification



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|                       | <p>of 90 <i>X. perforans</i> (1994-2012), 32 <i>X. gardneri</i> (1995-2015), and one <i>X. vesicatoria</i> (1996) strains. While <i>X. euvesicatoria</i> has never been found in tomato samples, 53 <i>X. euvesicatoria</i> strains have been isolated from clinical pepper samples (1987-2015). Evaluation of previously published conventional PCR-based diagnostic methods for xanthomonads using our strains from tomato and pepper showed that detection of <i>X. euvesicatoria</i> and <i>X. vesicatoria</i> was highly specific, but detection of <i>X. perforans</i> and <i>X. gardneri</i> was less reliable. We previously developed a multiplexed real-time PCR method for <i>X. gardneri</i>, which uses XGA_0724, a unique gene encoding a protein belonging to the type III effector arvBs1 class that possibly participates in increasing virulence on tomato, as the target. A set of primers and probe specific to the plant cytochrome oxidase (<i>Cox</i>) gene was included to help avoid false negatives resulting from poor quality samples. This method allowed us to detect <i>X. gardneri</i> at the level of 10<sup>3</sup> CFU/100 mg tissue of both tomato and pepper. Based on the molecular identification of <i>Xanthomonas</i> strains and corresponding cultures, we will sequence the whole genome of selected <i>X. gardneri</i> strains (1-2 strains per year) in collaboration with researchers in the USDA-ARS Vegetable Laboratory in Charleston, South Carolina in 2016. Resulting genome sequences will establish a foundation for investigating a few fundamental questions concerning this exotic pathogen species (e.g., have there been multiple introductions of this species to Pennsylvania?, what is similar and unique about this species compared with <i>X. euvesicatoria</i> and <i>X. vesicatoria</i>?, are there additional genes good for detecting and differentiating individual <i>Xanthomonas</i> species?).</p>   |
| Activities Preformed: | <p><b>5.1. Identification of <i>Phytophthora</i> isolates:</b> Because the internal transcribed spacer (ITS) region of ribosomal RNA-encoding genes of multiple isolates of all known <i>Phytophthora</i> species has been sequenced and archived in the <i>Phytophthora</i> Database (PD), sequencing of this region allows us to quickly identify new strains through the comparison of their ITS sequence with those archived in the PD. However, because the ITS itself is not sufficient to firmly conclude if they correspond to novel species or not, we will need to sequence additional genes so as to address this question. Genomic DNAs of many of the historical cultures already have been prepared.</p> <p><b>5.2. Organize historical data associated with <i>Phytophthora</i> diseases:</b> The PD will be modified to archive the historical data in a searchable format, which will allow us to take advantage of the existing data analysis and visualization tools in the PD.</p> <p><b>5.3. Development of comprehensive diagnostic resources:</b> We will provide people on the front lines of defense with the following identification and detection tools and sources of information.</p> <p><b>5.3.1. Molecular tools:</b> Plant pathologists have become increasingly dependent on DNA sequences to identify and detect pathogens. This application has been particularly important in instances where users may not possess the expertise or reference material necessary to make accurate identifications using morphological and cultural characteristics. Diagnostic markers for <i>Phytophthora</i> have been developed from several loci (e.g., ITS, <i>ypt1</i>, <math>\beta</math>-tubulin, elicitor, <i>cox</i> spacer). However, these primarily focus on identification of a particular species of interest and do not have the ability to identify the pathogen at a genus level using real time PCR. Having this capability would allow the detection of all <i>Phytophthora</i> species present in a sample, not just the target species of interest, and is critical to detect novel pathogenic species. A new multiplexed marker system that has a single genus specific amplicon with</p> |

annealing sites for genus and species-specific TaqMan probes addressing this need was recently developed by Dr. Frank Martin at USDA-ARS. We will work with him to develop probes and protocols for the species that are considered main threats to specialty crops.

**5.3.2. Phenotype-based identification tools:** Although the PD provides a summary of key phenotypical characteristics of individual species via the species page, these are not designed to systematically support identification. To complement sequence-based identification, the PD will be linked to a new resource that is under development by Dr. Gloria Abad at USDA-APHIS. This new diagnostics resource will provide morphological data from *Phytophthora* species in two different formats: a) The Lucid Key is a matrix-based identification tool based on a set of 22 morphological features and 92 character states; and b) The Tabular Key ([17](#)) helps users to quickly narrow down the likely identify of a new isolate using morphological features and design additional observations to confirm its identity.

**5.3.3. Information resource:** Via the PD, we will provide reviews of latest disease outbreaks, diagnostic protocols, and community news via a blog interface of the PD.

**5.4. Dissemination of resulting knowledge and resources:** The American Phytophthological Society meeting and local extension meetings will be the main conduits for disseminating new results and resources from this project.

#### Project Activity

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| Sequence-based identification of archived <i>Phytophthora</i> isolates |
| Archiving of historical data   |
| Collection and organization of phenotypic identification keys          |
| Development and evaluation of molecular diagnostic tools               |
| Collection and curation of protocols and references                    |
| Disseminate research results to relevant organizations                 |
| Project meeting/conference   |

#### 6. Literatures Cited

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| Beneficiaries:   | <p>One of the project's primary beneficiaries is Pennsylvania's Christmas tree industry and individual growers. Christmas tree industry in PA has been ranked within the top four in the United States with &gt;1,000 Christmas tree farms generating more than \$22 million in annual sales in recent years. Christmas tree root rot caused by <i>Phytophthora</i> species is accountable for heavy losses in seedling beds and plantations for many years in PA. A comprehensive understanding of the type of <i>Phytophthora</i> species that cause Christmas tree root rot and their geographical and temporal distribution patterns will help guide disease management and focused pathogen survey. Similarly, the nature and historical pattern of bacterial pathogens that have affected tomato and pepper plants in state, as well as molecular tools that enable differentiation of three main pathogenic <i>Xanthomonas</i> species will support Pennsylvania's vegetable industries in managing bacterial speck disease. Since <i>Phytophthora</i> and <i>Pythium</i> diseases are global problems, the improved <i>Phytophthora</i> Database (PD), as well as an online identification tool for <i>Pythium</i>, will benefit vegetable and ornamental industries and diagnosticians in many other states as well as those outside of the United States. In 2015, the PD has been utilized ~1,500 times per month on average. Even though it would be difficult to quantify the exact amount of savings, this project likely has benefitted many in specialty crop industries by helping them respond to emerging disease problems early. The enhanced diagnostics capability at PDA and Penn State Plant Disease Clinic continuously place both organizations at the forefront of protecting specialty crops.</p> |
| Lessons Learned: | <p>The dynamic nature of pathogen movement underscores the importance of continuously monitoring the nature and profiles of pathogens that affect various specialty crops in Pennsylvania. Characterization of historical data and pathogen cultures archived at PDA has provided critical insights into how individual pathogen communities are structured and have changed in the state, thus helping our capability of managing future problems. We plan to conduct a few experiments in 2016 based on the data resulted from this year's project</p>  |

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|                         | towards the goal of enhancing the state’s preparedness against several major pathogens that threaten specialty crops.   |
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| Additional Information: | O’Donnell, K., Ward, T., Robert, V. A. R. G., Crous, P. W., Geiser, D. M., and <b>Kang, S.</b> (2015) DNA sequence-based identification of <i>Fusarium</i> : Current status and future directions. <i>Phytoparasitica</i> 43:583-595 ( <i>This review outlined how DNA sequence data can be used to identify and delineate Fusarium species and how to avoid common pitfalls in using DNA sequence for strain identification. Even though Fusarium is not one of the target organisms of this project, this review is relevant to those who deal with different pathogen groups using pathogen DNA sequences</i> )<br><b>Nikolaeva, E. V.</b> , Olson, T., Welliver, R., Piergallini, T., <b>Kang, S.</b> , and <b>Kim, S. H.</b> (2015) Historical Diversity and Molecular Diagnosis of Bacterial Pathogens on Tomato in Pennsylvania. Proceedings of 30th Tomato Disease Workshop. Baton Rouge, LA. ( <i>oral presentation</i> ). Self-guided online training program for the identification of <i>Pythium</i> species at <a href="http://plantpath.psu.edu/pythium">http://plantpath.psu.edu/pythium</a> |
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